Milk River Watershed Hydrologic Analysis
Volume 2 – Stream Gage Analyses
Valley, Hill, Blaine, and Phillips Counties, MT

June 2021

Michael Baker
INTERNATIONAL

Document History

Document Location

Location

Revision History

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01	02/26/2021	Initial Submittal	R. Anderson
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03	06/30/2021	Report and figure edits	R. Anderson

Client Distribution

Name	Title/Organization	Location

Cover Photo: Confluence of Milk and Missouri Rivers. Photo by Rick and Susie Graetz. Accessed: http://www.umt.edu/this-is-montana/columns/stories/milk-river.php. Accessed September 24, 2020.

Michael Baker
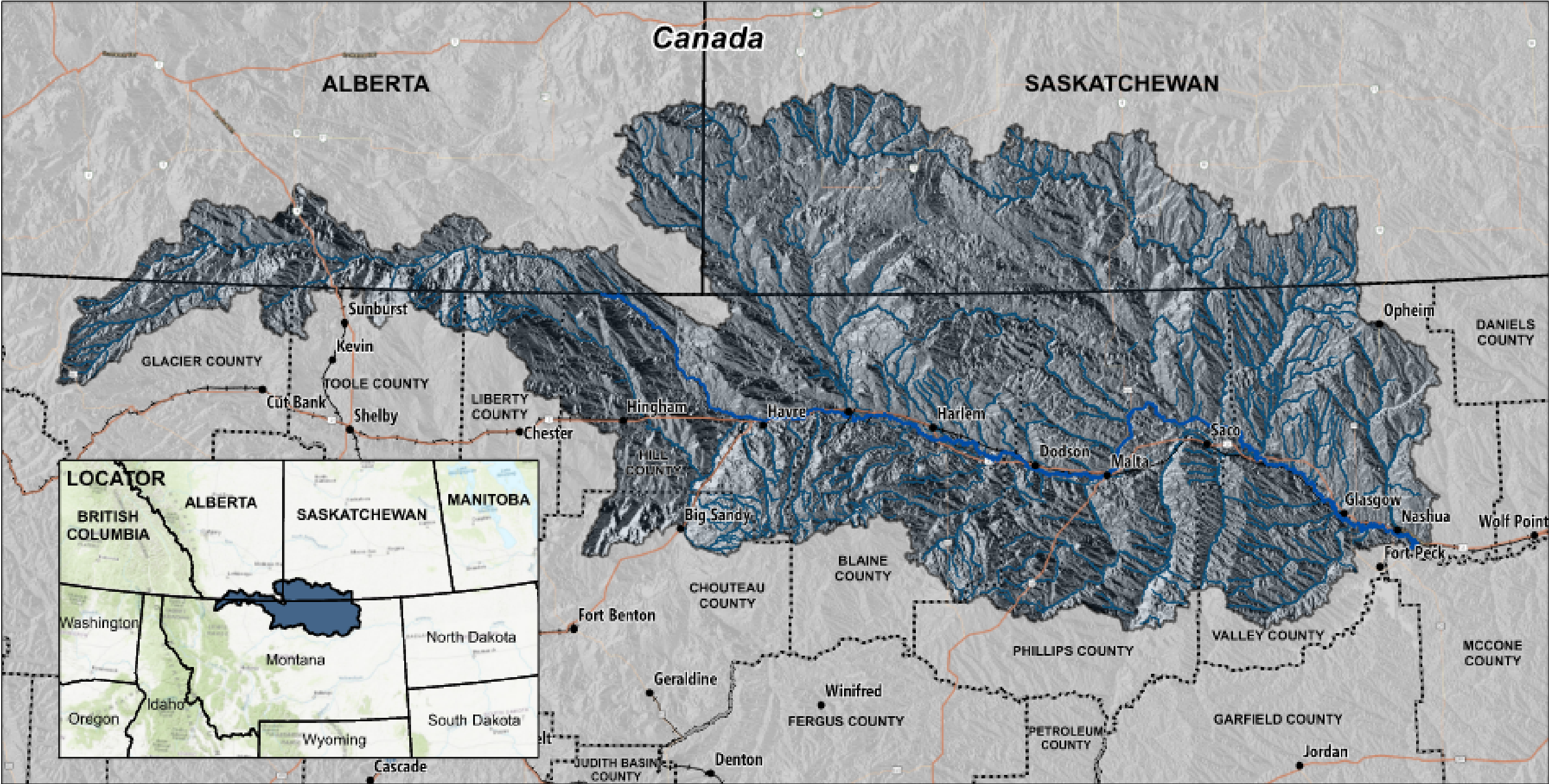INTERNATIONAL

Table of Contents

1. Executive Summary

Hydrologic analyses have been performed on gaged and ungaged portions of the Milk River and tributaries within the Milk River watershed. These hydrologic analyses will support future hydraulic analyses that will lead to updated floodplain mapping and development of other flood risk products to revise flood risk information to the communities within the Milk River watershed in Valley, Phillips, Blaine, and Hill Counties, Montana (**Figure 1**). As part of this Milk River watershed study, a separate hydrologic analysis has previously been completed as Volume 1 of the Milk River Hydrologic Analysis (Michael Baker, 2020) and included select tributaries that were studied using Base Level Engineering methods as well as closed basin, lakes, and other water bodies within the watershed. This study (Volume 2) includes the mainstem Milk River and remaining study area tributaries that will be analyzed using Enhanced study methods.

The hydrologic analyses were performed to establish peak discharges for the 10%, 4%, 2%, 1% and 0.2% Annual Exceedance Probability flood events. Additionally, peak discharges were determined for a standard error of prediction above the 1% Annual Exceedance Probability event to demonstrate a level of uncertainty in the computed discharge values, and, ultimately, the calculated flood elevations. For FEMA-based flood risk products, this discharge value above the 1% Annual Exceedance Probability is known as the 1% Plus discharge. Peak discharges were determined on 14 tributaries covering about 180 miles within the watershed. Intermediate flow change locations were identified on the tributaries based on watershed characteristics to account for the features within the watershed that result in the changes in flow as the river flows downstream through the watershed. The flow nodes were located at significant tributaries and other substantial increases in drainage area which can account for flow increases along the river. These additional flow change locations (flow nodes) within the tributaries resulted in approximately 29 pour points along the gaged tributaries within the watershed.

Flood-frequency peak flow analyses were performed by USGS on 61 stream gages on the mainstem Milk River and select tributaries (Siefken, *et al.*, 2021). The flood-frequency peak flow analyses were performed using Bulletin 17C "Guidelines for Determining Flood Flow Frequency" (England *et al.*, 2017) methodologies. For the tributaries without stream gages, the USGS water resources web application, StreamStats, was utilized to determine the peak discharge values based on regional regression equations for the 11 non-gaged tributaries included in the analysis. StreamStats applies regional regression equations for a location of interest based on the Hydrologic Region and basin characteristics of the location. Most of the tributaries included in the hydrologic analysis are located within the Northeast Plains Hydrologic Region, although some are also located in the East-Central Plains Hydrologic Region. The flow locations of interest were input to StreamStats via the batch process tool within StreamStats. A quality check was performed on the StreamStats output using basin characteristics derived from Digital Elevation Models developed from recently collected high-resolution LiDAR data. Discrepancies between StreamStats and LiDAR derived output were manually reviewed and the StreamStats results were adjusted as required to correct any StreamStats processed discrepancies.

The flow values were determined using methods that meet FEMA guidance and standards and are considered to be reliable for use in future flood risk products.

MILK RIVER BASIN
STUDY AREA

FIGURE 1

Legend

Milk River Basin — Milk River
Counties — Major Roads
Province ┼┼┼ Railroads
• Towns

DATA FRAME PROPERTIES:
Coordinate System: NAD 1983 2011 StatePlane Montana FIPS 2500 Ft Intl
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot

0   12.5   25   50   Miles

2. Introduction

Under contract to the State of Montana's Department of Natural Resources and Conservation (DNRC), Michael Baker International (Baker) has been tasked with preparing hydrologic data and documentation for floodplain studies within the Milk River watershed to include mainstem Milk River and select tributaries within Valley, Phillips, Blaine, and Hill Counties, Montana (**Figure 1**). The purpose of the hydrologic analyses is to provide new and updated hydrologic information that will be subsequently used in floodplain mapping activities within the Milk River watershed. The State of Montana is a Cooperating Technical Partner (CTP) with the US Department of Homeland Security (DHS) Federal Emergency Management Agency (FEMA), and this work is performed under Mapping Activity Statement (MAS) Number 2019-01, Milk River Watershed, Phase I.

This hydrologic analysis for the Milk River watershed is the second part (Volume 2) of the hydrologic analyses being performed for the Milk River watershed and supplements previous analyses (Volume 1) by providing the results of peak-flow frequency analyses performed on stream gages for the mainstem Milk River and select gaged tributaries within the watershed, as well as regression analyses for other ungaged tributaries to the Milk River. The tributaries (gaged and ungaged) reported in this analysis are those within the four-county study area that will receive enhanced hydraulic analyses during the hydraulic data capture portion of this phase of the overall project. **Table 1** lists information about those select tributaries.

Two significant instream and mainstem reservoirs (Fresno and Fort Peck Reservoirs) have been identified as water body features that will be included in future study reaches evaluated using enhanced methods. These reservoirs are reliant on peak-flow frequency analyses reported herein to describe the appropriate hydrologic input parameters for the future hydraulic analyses and floodplain mapping. As such, the results of hydrologic analyses for Fresno and Fort Peck Reservoirs are included in this report (other significant reservoirs, lakes, ponds, impoundments, and closed basin features are described in Volume 1).

Table 1. List of flooding sources included in enhanced analyses.

Study Area/Flooding Source	Type of Study	Gaged / Ungaged	Miles of Hydraulic Analysis
Valley County			
Porcupine Creek	Enhanced (with floodway)	Gaged	18.7
Cherry Creek	Enhanced (with floodway)	Ungaged	13.9
East Fork Cherry Creek	Enhanced (with floodway)	Ungaged	4.7
Spring Creek Coulee	Enhanced (with floodway)	Ungaged	2.8
Missouri River	Enhanced	Gaged	14.3
Phillips County			
Beaver Creek	Enhanced (with floodway)	Gaged	5.8
Dodson Creek	Enhanced (with floodway)	Ungaged	4.3
Blaine County			
Redrock Coulee	Enhanced (with floodway)	Ungaged	3.1
	Enhanced		8.6
Lodge Creek	Enhanced (with floodway)	Ungaged	4.5
	Enhanced		5.5
Battle Creek	Enhanced	Ungaged	7.9
Thirtymile Creek	Enhanced	Ungaged	4.8
Hill County			
Beaver Creek	Enhanced (with floodway)	Gaged[1]	4.0
	Enhanced		9.3
Big Sandy Creek	Enhanced	Gaged	3.8
Bullhook Creek Complex	Enhanced	Ungaged	0.8
England Coulee	Enhanced	Ungaged	1.4

[1] Note peak-flow frequency analyses were not performed for this gaged tributary (see **Section 5.0** for discussion)

Figures 2 – 15 identify the location and indicate the extents of the sub-watersheds that are included in this hydrologic analysis. A previous Hydrologic report (Volume 1) included the remainder of the ungaged tributaries that will be studied by approximate study methods using Base Level Engineering (BLE), as well as other water bodies (closed basins, lakes, ponds, reservoirs, etc.) that are part of the overall study area.
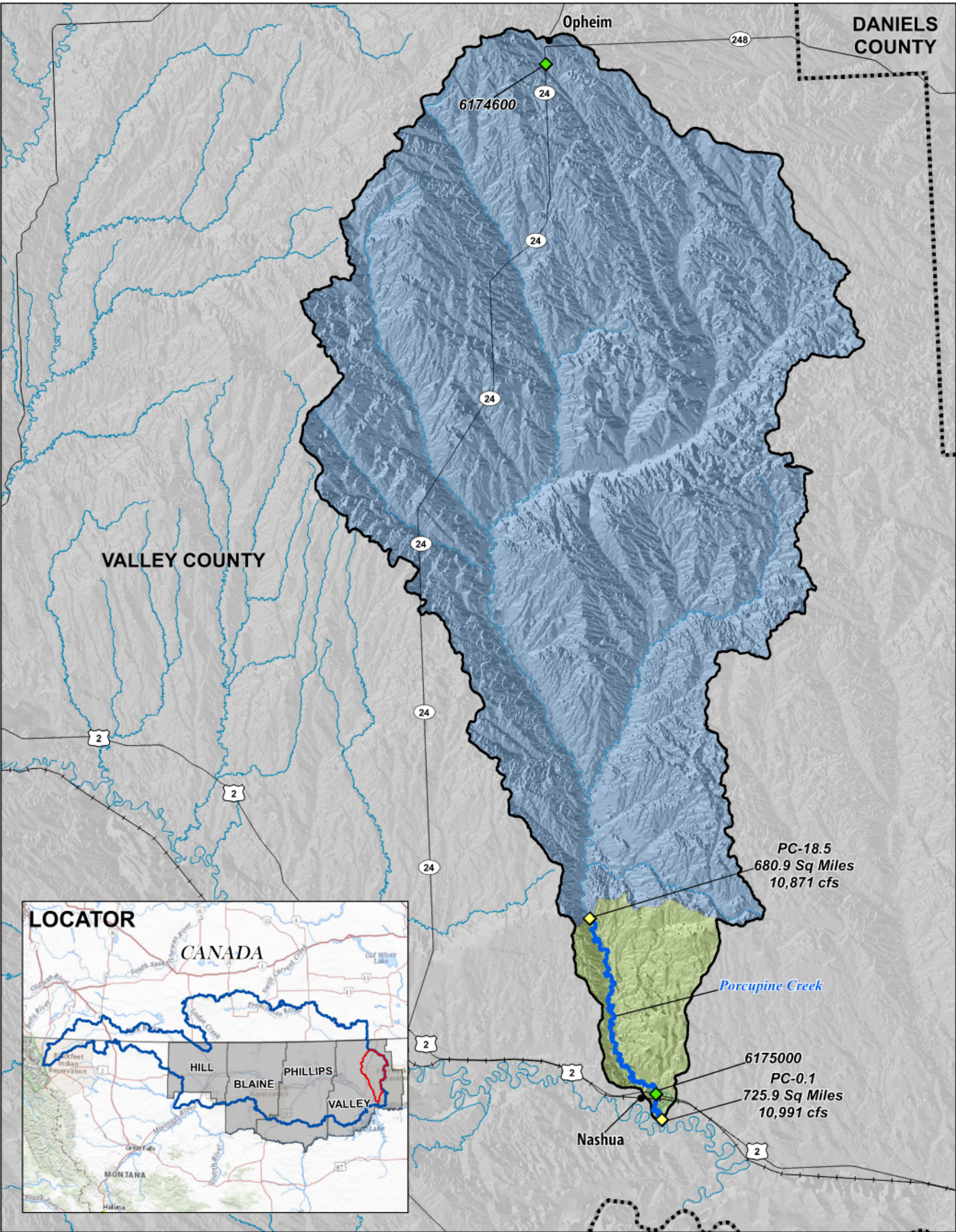
DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES PORCUPINE CREEK WATERSHED

FIGURE 2

Map Date: 5/7/21

LOCATOR

CANADA

HILL   BLAINE   VALLEY

PHILLIPS

MONTANA

VALLEY COUNTY

CC-14.1
55.7 Sq Miles
2,980 cfs

CC-9.6
57.3 Sq Miles
3,020 cfs

CC-6.9
136.3 Sq Miles
4,430 cfs

Cherry Creek

Glasgow

CC-0.1
143.5 Sq Miles
4,530 cfs

Legend

Cherry Creek 1	• Towns		
Cherry Creek 2	Railroads		
Cherry Creek 3	Interstate		
Cherry Creek 4	Highway		
◇ Flow Nodes	Counties		

MONTANA DNRC

Michael Baker
INTERNATIONAL

DATA FRAME PROPERTIES:
Coordinate System: NAD 1983 2011 StatePlane Montana FIPS 2500 Ft Intl
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot

**DRAINAGE AREA AND
RECOMMENDED
1% AEP DISCHARGES
CHERRY CREEK
WATERSHED**

Miles
0   1   2   4

N

FIGURE 3

Map Date: 5/7/2021

LOCATOR

CANADA

HILL   BLAINE   VALLEY   PHILLIPS

MONTANA

VALLEY COUNTY

EFC-0.1
66.4 Sq Miles
3,130 cfs

EFC-3.9
47.9 Sq Miles
2,710 cfs

EFC-4.7
28.5 Sq Miles
2,220 cfs

East Fork
Cherry Creek

Legend

East Fork Cherry Creek 1
East Fork Cherry Creek 2
East Fork Cherry Creek 3
Flow Nodes
Towns

Counties
Interstate
Highway
Railroads

DNRC
MONTANA

Michael Baker
INTERNATIONAL

DATA FRAME PROPERTIES:
Coordinate System: NAD 1983 StatePlane Montana FIPS 2500
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter

Miles
0   0.5   1   2

N

**DRAINAGE AREA AND
RECOMMENDED
1% AEP DISCHARGES
EAST FORK CHERRY
CREEK WATERSHED**

FIGURE 4

Map Date: 5/7/21

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES SPRING CREEK COULEE WATERSHED

FIGURE 5

Map Date: 5/7/21

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES BEAVER CREEK WATERSHED (Near Saco)

FIGURE 6

Map Date: 5/7/21

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES DODSON CREEK WATERSHED

FIGURE 7

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES REDROCK COULEE WATERSHED

FIGURE 8

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES LODGE CREEK WATERSHED

FIGURE 9
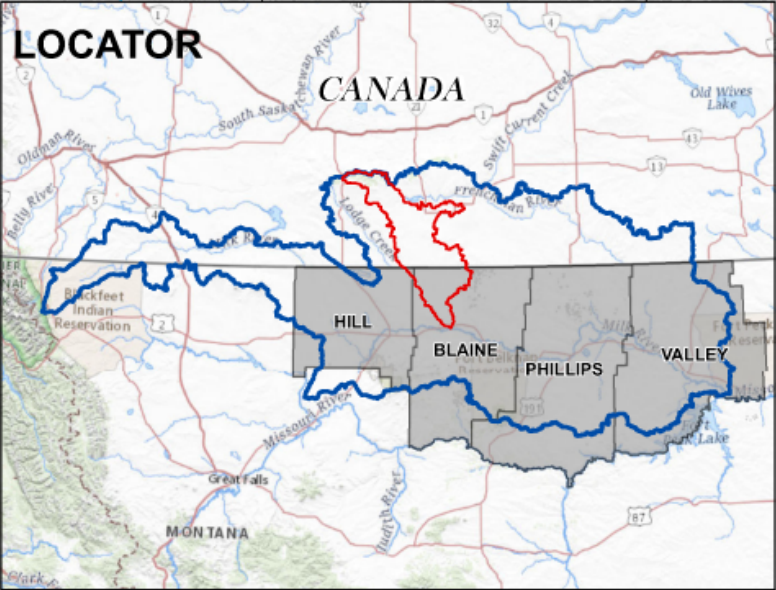
DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES BATTLE CREEK WATERSHED

FIGURE 10

Map Date: 5/7/21

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES THIRTYMILE CREEK WATERSHED

FIGURE 11

Map Date: 5/7/21

Figure 12. Drainage Area and Recommended 1% AEP Discharges Beaver Creek Watershed (Near Havre)

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES BIG SANDY CREEK WATERSHED

FIGURE 13
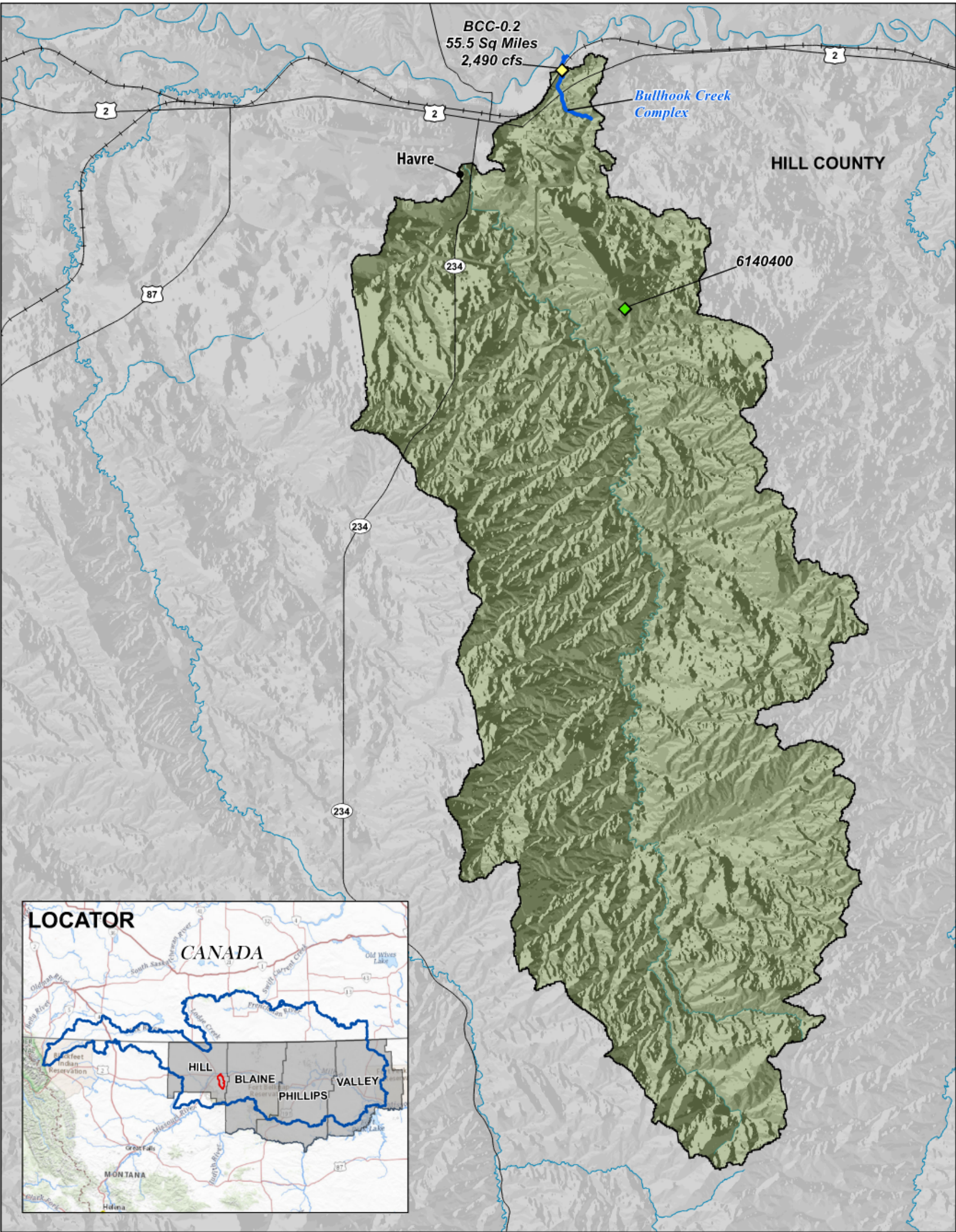
BCC-0.2
55.5 Sq Miles
2,490 cfs

Bullhook Creek Complex

HILL COUNTY

Havre

6140400

LOCATOR

CANADA

HILL
BLAINE
PHILLIPS
VALLEY

MONTANA

Legend

Bullhook Creek 1

Flow Nodes

USGS Gages

Towns

Counties

Interstate

Highway

Railroads

DNRC

Michael Baker
INTERNATIONAL
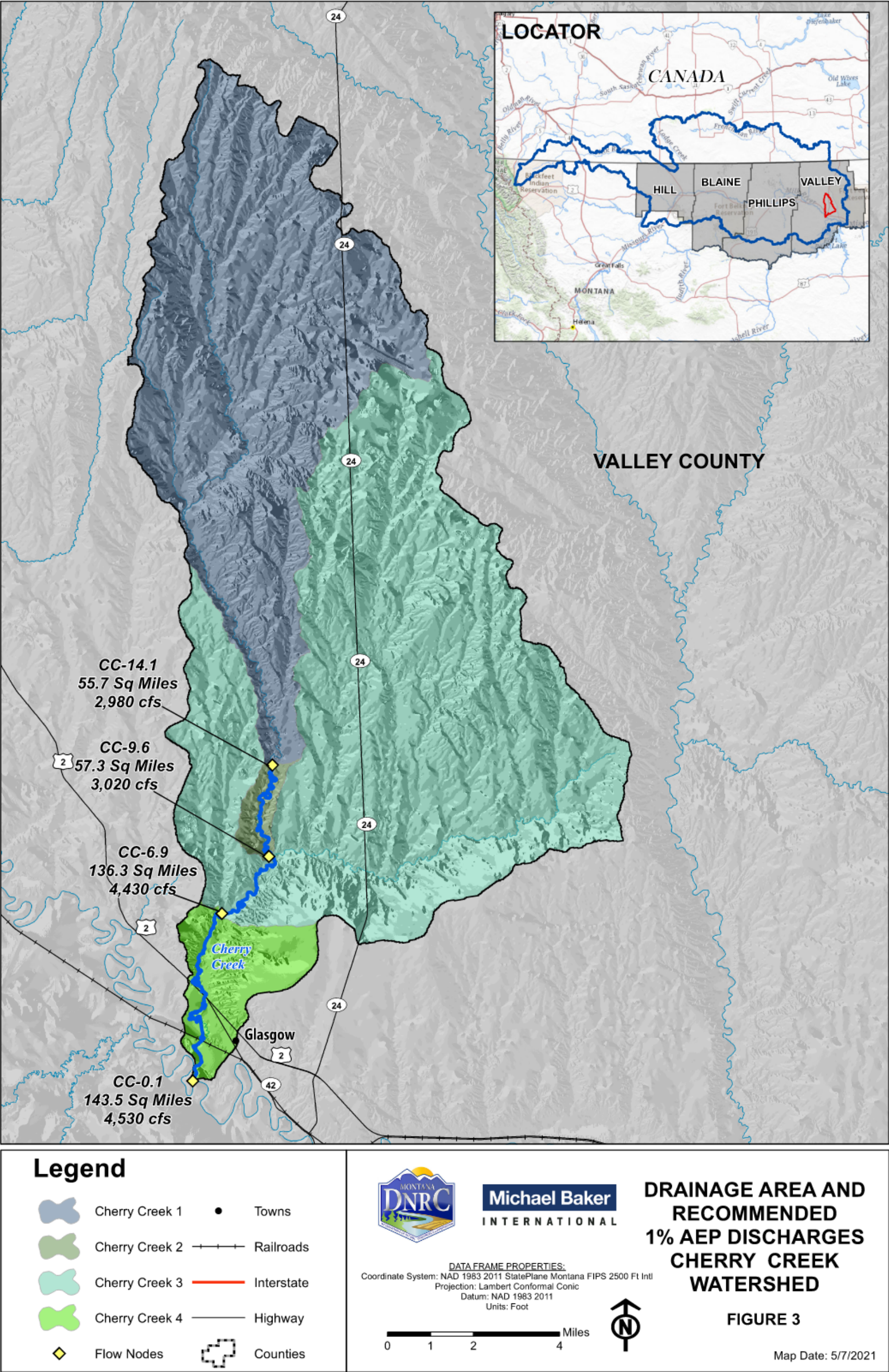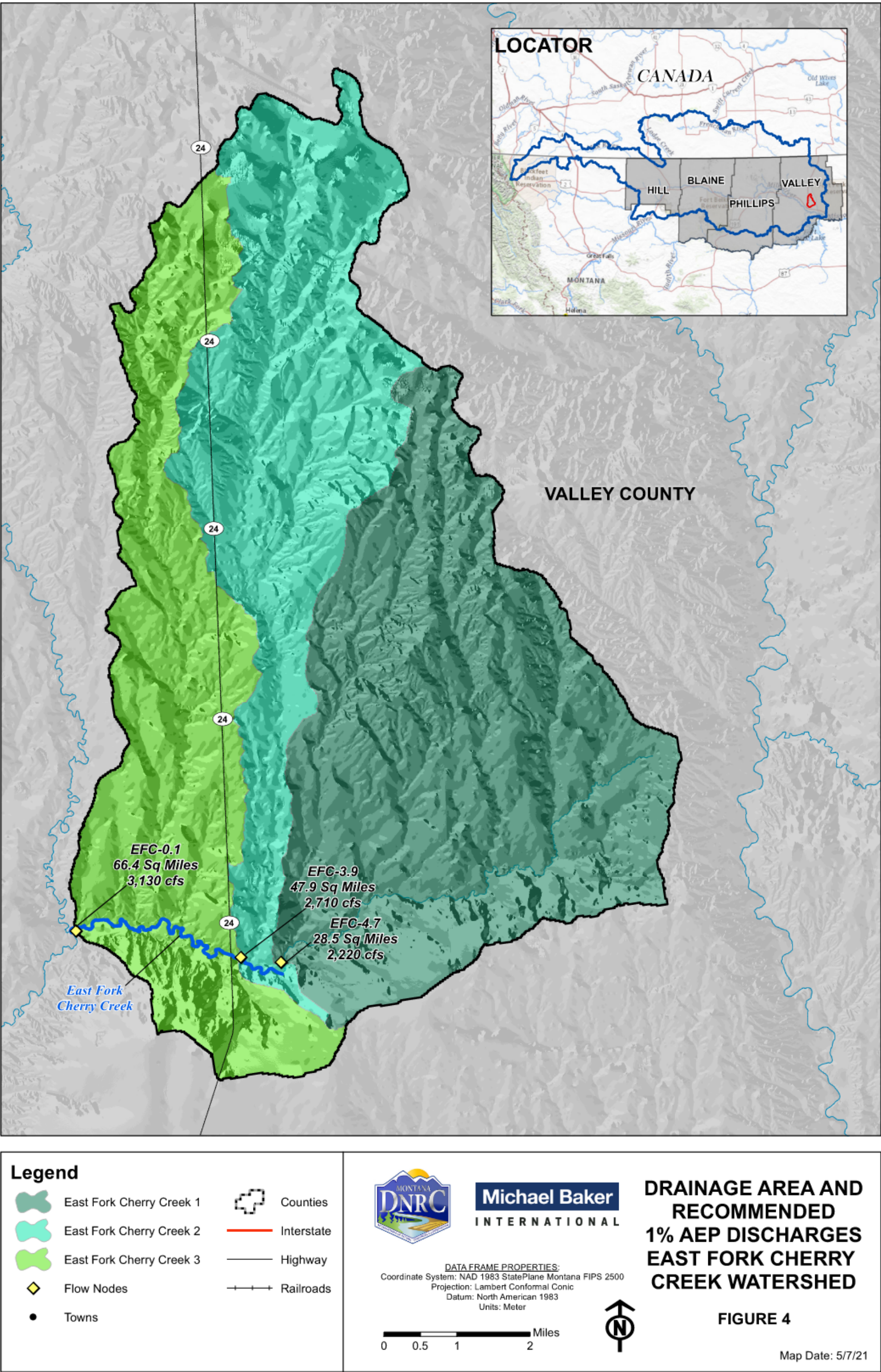
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Units: Foot

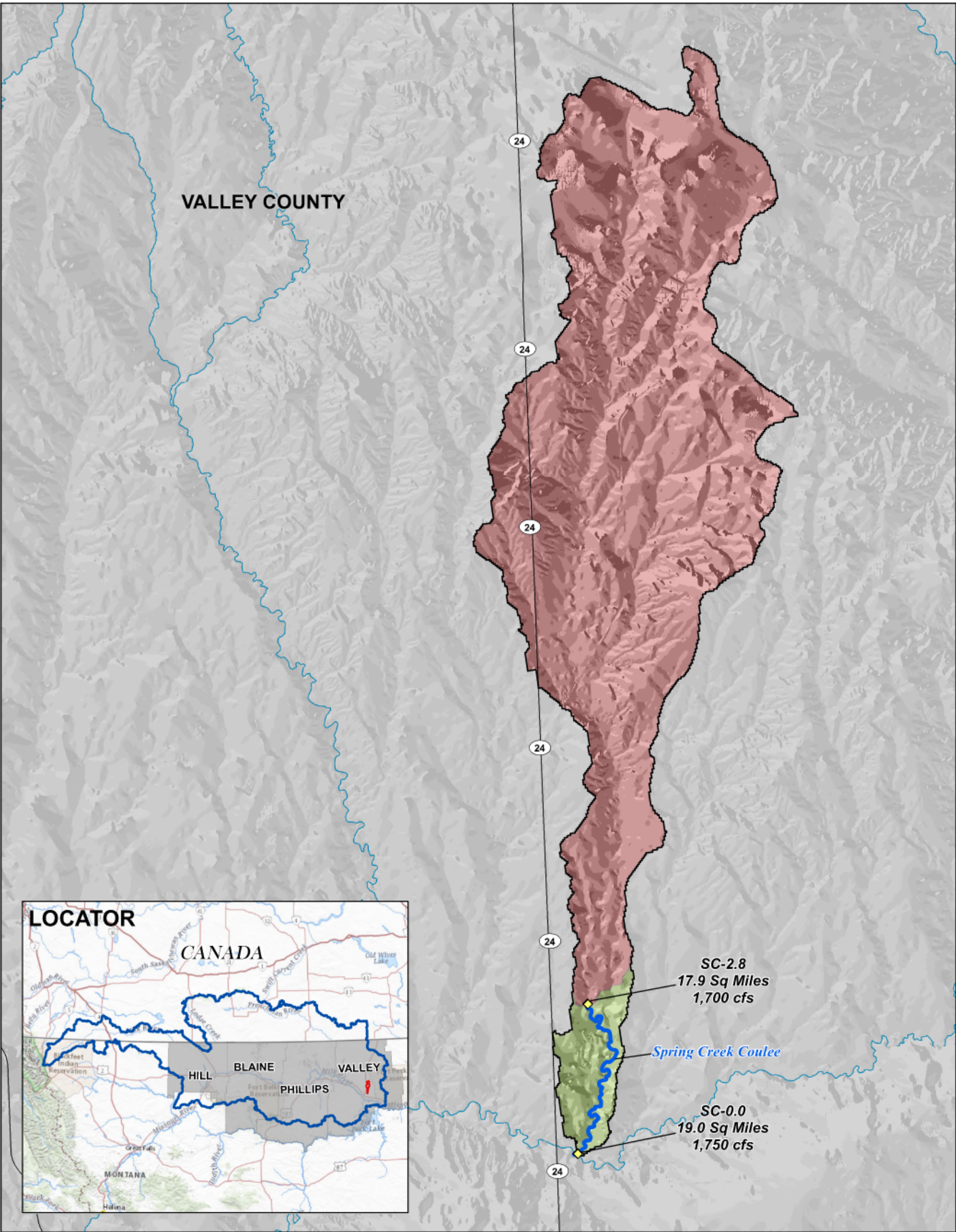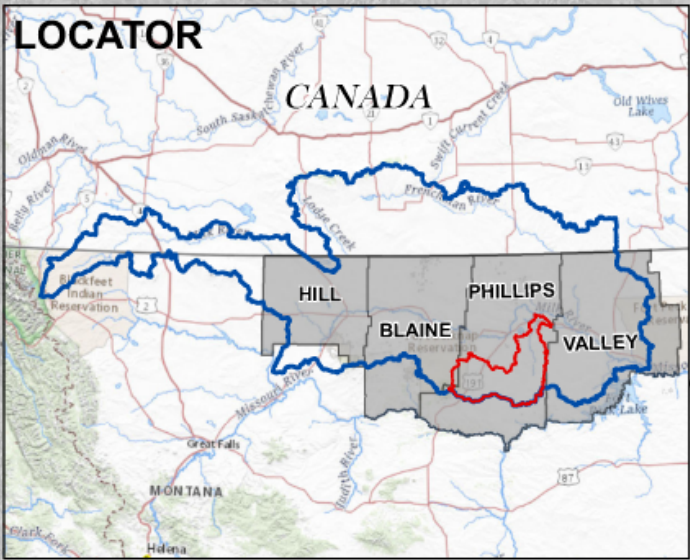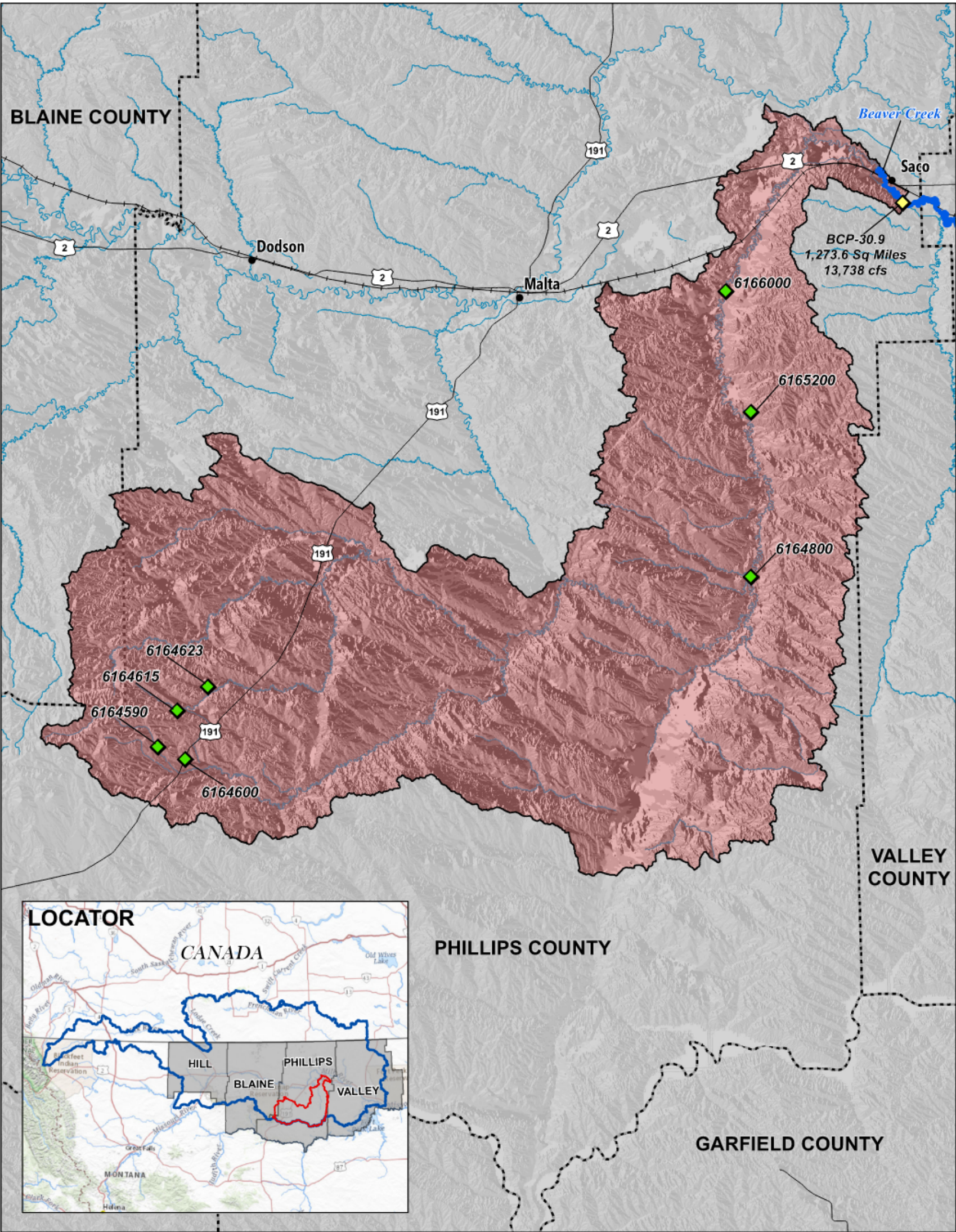Miles
0   0.5   1   2

N

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES BULLHOOK CREEK WATERSHED
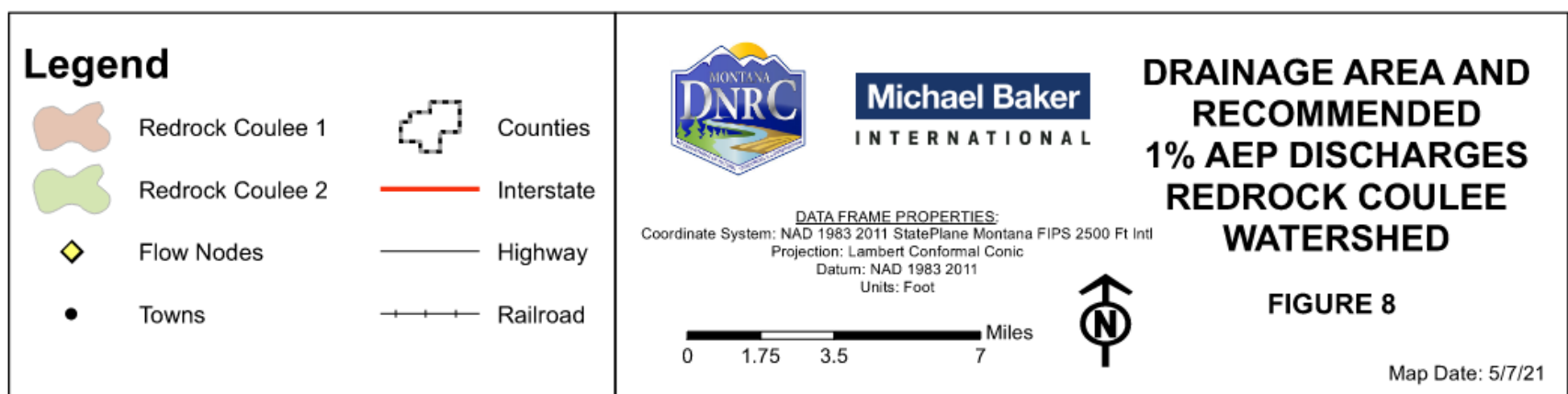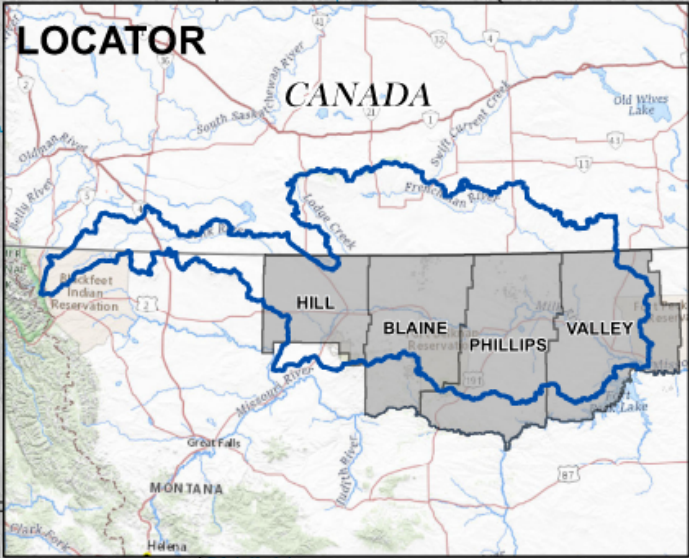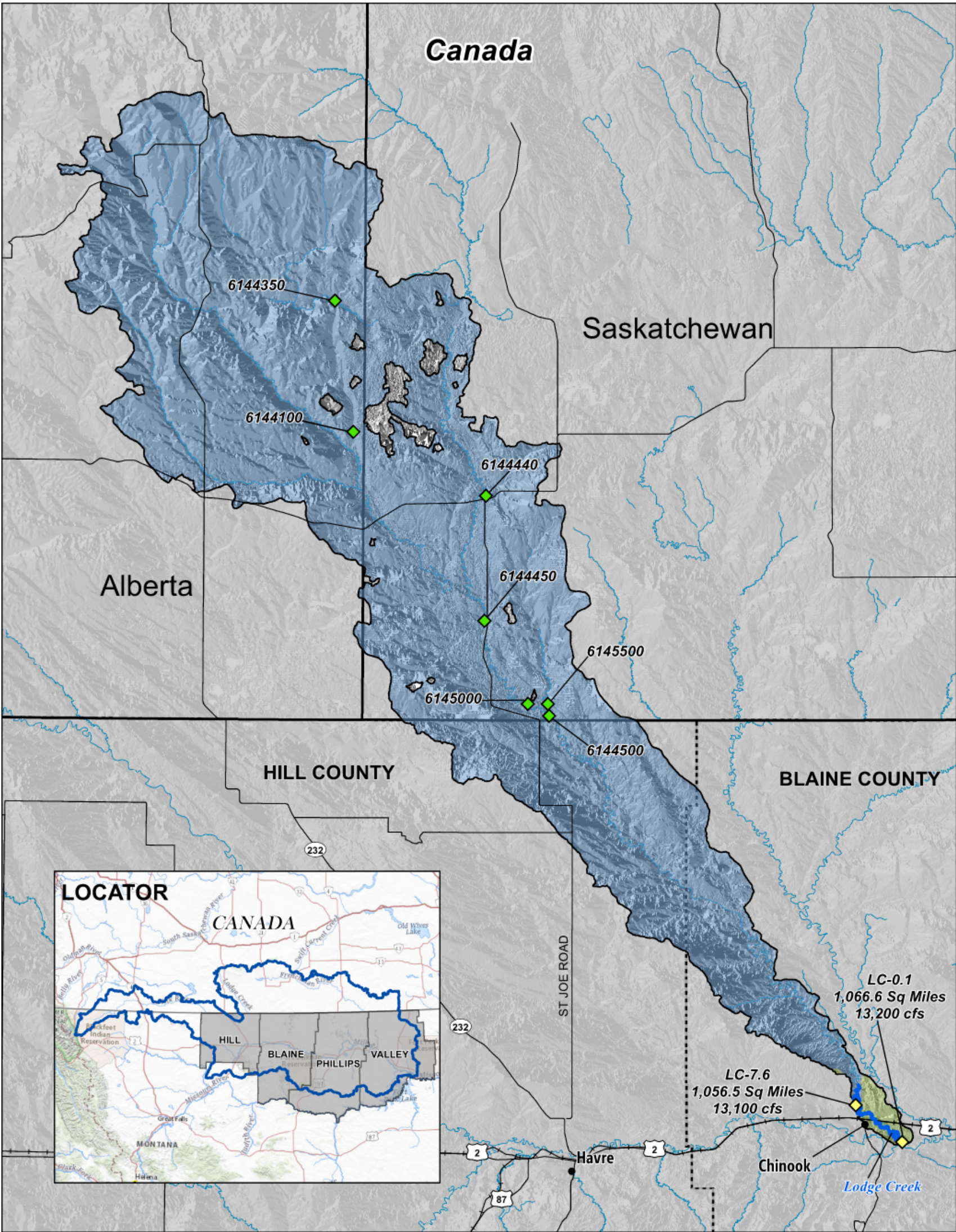
FIGURE 14

Map Date: 5/7/21
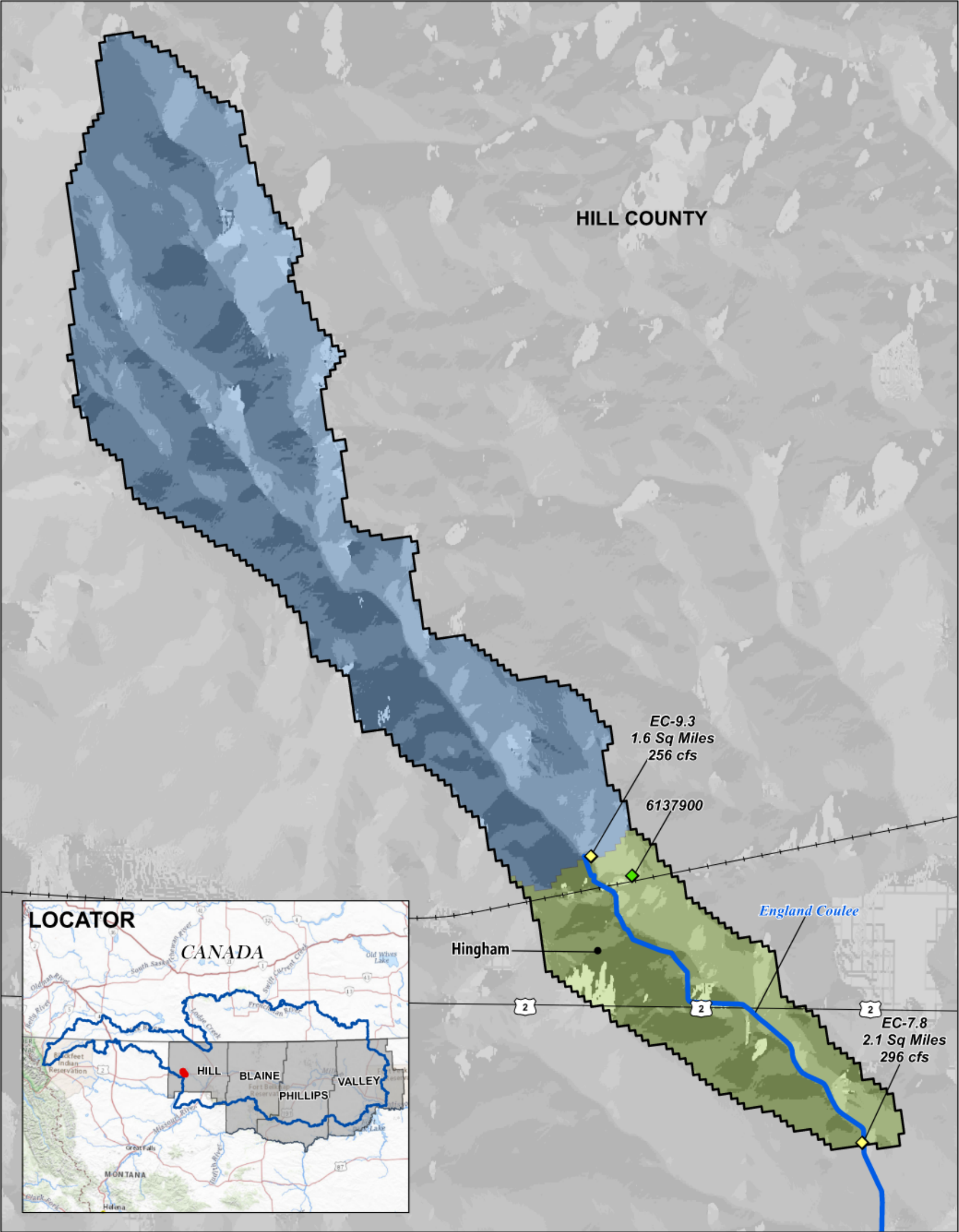
DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES ENGLAND COULEE WATERSHED

FIGURE 15

Map Date: 5/7/21

2.1. Background Information and Existing Flood Hazards

As a participant in FEMA's CTP program, The State of Montana works in collaboration with FEMA to identify flood hazards and communicate flood risk to communities throughout the state, and to assist with administration of the National Flood Insurance Program (NFIP).   In this role, the State also engages with communities to provide technical and community outreach resources related to implementation of the NFIP, the Montana Floodplain and Floodway Management Act (1971), and the Montana Code Annotated. Annually, the State identifies and prioritizes specific study and mapping projects and applies to FEMA for funding to implement these projects and other related program activities. The hydrologic evaluation of the Milk River and tributaries is one element of a project identified and prioritized for the Milk River Watershed Phase I study. The ultimate goal of the study is to provide new and updated flood hazard risk information to the communities within the Milk River watershed.

Existing flood hazard information within the Milk River watershed is dated and quite limited given the broad extent and considerable flood risk posed by the Milk River and tributaries; however some locations within the watershed do have more recent and more detailed flood risk information. Flood hazard information has been published by FEMA on a Flood Insurance Rate Map (FIRM) for Valley, Phillips, Blaine, and Hill Counties. With the exception of a few tributaries and short reaches of the mainstem Milk River, the Milk River and tributaries within the four-county study area are currently mapped as Zone A on the FIRMs.

2.2. Basin Description

The Milk River Basin is situated along the Northern border of Montana and spans approximately 729 miles along its general east-to-west orientation. Its headwaters originate high in the northern Rocky Mountains near Glacier National Park within the Blackfeet Indian Reservation. The Milk River basin is unique in that it is the only basin in the country that originates within the United States, leaves the country flowing north into Canada for nearly 200 miles, re-enters the United States in Montana, and joins the Missouri River on its way to the Gulf of Mexico. The Milk River Basin receives water from the adjacent St. Mary's Basin via a trans-basin diversion known as the Milk River Project, which was installed in 1905 to provide additional stream flow for irrigation of approximately 140,000 acres in the Milk River Basin, mostly within Valley, Phillips, Blaine, and Hill Counties.   The river is often referred to as "the life-line of the hi-line" as it is a critical component to the agriculture, with numerous diversion dams providing much needed irrigation on the northern Montana prairie. The geology of the region consists of unconsolidated alluvium, glacial till, glacial lake deposits, and outwash deposits, mainly silt, sand, and gravel.

"Lewis and Clark mention the Milk River in their journals. It was one of the landmarks the Hidatsa Indians had told them to look for on their way west. The Indians called the Milk "the River that scolds all others". On May 8, 1805, Meriwether Lewis noted "...the water of this river possessed a peculiar whiteness, being about the colour of a cup of tea with the admixture of a tabelspoolfull of milk. From

the colour of its water we called it Milk River. We think it possible that this may be the river called by the Minitares (Hidatsa) 'the river that scolds at all others' "(Milk River International Alliance, 1999).

A majority of the Milk River Watershed lies within the Northeast Plains Hydrologic Region, although a small portion of the Milk River watershed and tributaries included in this analysis extend into the Northwest Foothills Hydrologic Region, and some of the lower reaches are located in the East-Central Plains Hydrologic Region. This region is generally described as rolling prairie. Floods on larger streams in this region are caused by prairie snowmelt or snowmelt mixed with rain. Thunderstorms are more prevalent in eastern Montana than in western Montana, and thunderstorms are highly variable in terms of extent, location, and precipitation amounts and intensities. Most floods on smaller streams are caused by thunderstorms. Annual peak discharges are more variable than those from streams in the Northwest Foothills region (Sando and McCarthy, 2018c).

The snowmelt runoff is affected by several mechanisms including air temperature during the spring breakup season, with baseline conditions influenced by the level of saturation of the contributing watersheds prior to fall freeze up, as well as the duration of sustained cold winter weather.

In general, the snowmelt runoff in a watershed begins in the lower, warmer elevations (near the mouth of the system) and progresses to the higher elevations in the basin. Following that pattern, the Milk River would begin to melt first in the eastern portion of the basin, near the communities of Nashua and Glasgow, with melting continuing towards the west and higher elevations. This system is somewhat unique in that the chinook winds that can occur on the eastern slopes of the Rocky Mountains, cause warm air to begin the melting processes in the upper, western portions of the watershed. This drives the breakup processes from west to east.

During years with chinook influence, as snowmelt begins to flow from the west towards the still frozen eastern plains, the runoff can encounter portions of the river with intact channel ice. The energy of the runoff can breakup and lift channel ice, transporting it downstream to a location with limited conveyance capacity, causing an ice jam with resultant upstream backwater and flooding. Ice jams can also occur without the influence of a chinook winds driven melt.

The Fresno Dam, located 15 miles upstream of Havre, has regulated peak flows on the Milk River since its completion in 1939. However, the contributing drainage area at the Fresno Reservoir is 3,766 square miles, and the effect of regulation is reduced as the Milk River flows toward the east and intercepts large unregulated tributaries (FEMA, 2006). The routing effects of the reservoir can be observed in the discharge of some of the larger storms on record. **Table 2** presents the inflow and outflow for some of the larger storms as taken from the Effective FEMA Flood Insurance Studies for Hill and Blaine Counties. (FEMA, 2006, 1988).

Table 2. Fresno Reservoir Inflow and Outflow Rates for Storms of Record (FEMA, 2006, 1988)

Year	Inflow (cfs)	Outflow (cfs)
1952	17,600	6,550
1965	11,594	3,689
1978	10,338	2,325

Ample stream gages exist throughout the basin and especially along the Milk River and its tributaries in Valley, Phillips, Blaine, and Hill counties. Effective flood hazard mapping data exists in both digital (FEMA NFHL) and paper formats throughout the basin, and certain areas remain unmapped. As a separate task to DNRC, Baker has digitized the effective flood hazard maps. Population throughout the four counties listed above is concentrated along the Milk River, in the Fort Belknap Reservation, and in small towns that dot the watershed.

The National Inventory of Dams (NID), compiled by the USACE, shows a significant amount of impoundment occurring throughout the lower Milk River Basin. There are over 600 features classified as dams in the Milk River Basin according to NID, 14 of which are classified as high hazard.

Much of the land use adjacent to the Milk River floodplain and its tributaries is classified as agricultural (farming and ranching). While many small farming communities are present along the entire length of Milk River, the setting is almost entirely rural, with Havre having the highest population (nearly 10,000) followed by Glasgow (just over 3,300), and Malta (approximately 1,900). These are the largest communities within Valley, Phillips, Blaine, and Hill County study area. The study area includes portions of the Fort Peck Indian Reservation in Western Valley County and Fort Belknap Indian Community in Blaine and Phillips Counties. US Highway 2 is the main east-west thoroughfare, locally referred to has the Hi-Line, and generally follows the Milk River flow path. In addition to Highway 2, there are numerous county roads, city streets, private drives, farm/ranch accesses, and the Burlington Northern and Santa Fe Railway with bridges that cross the Milk River and tributaries.

Numerous irrigation systems divert water from the Milk River and tributaries. While significant in the flows they divert from the Milk River during the lower flow irrigation season, these diversions are typically not in operation or are relatively minor diversions in the context of significant flood events – their purpose is to deliver water to farms and ranches within, or very near, the Milk River or tributary floodplain during lower flow conditions. Fresno Reservoir is a major irrigation storage reservoir on the Milk River upstream of Havre that also provides significant flood storage for the Milk River. Other significant storage reservoirs on the Milk River and tributaries include Dodson Dam near the community of Dodson in Phillips County and Frenchman Dam on Frenchman Creek near the town of Saco in Phillips County, MT. As noted above, much of the land along the Milk River and its tributaries is in private ownership; primarily as farms, ranches, and the businesses and residents of the communities along the rivers. Throughout the remainder of the watershed, however, most of the land ownership is public land – managed primarily by the Fort Peck Indian Reservation, Fort Belknap Indian Community, US Bureau of Land Management, US Fish and Wildlife Service, and the State of Montana.

The Milk River watershed elevation ranges from 2,031 feet above MSL at the confluence with the Missouri River to over 8,700 feet in the watershed's mountain peaks in Glacier National Park. The mean basin elevation is 3,000 feet, and only approximately 1% of the basin is at an elevation above 5,000 ft. Only about 1% of the watershed is forested. Based on data collected using USGS

StreamStats (McCarthy *et al.* 2016), mean annual precipitation averaged across the watershed is 13.5 inches per year. Temperatures vary widely across the watershed as well, with wintertime low temperatures frequently dropping well below zero degrees Fahrenheit, and summertime high temperatures average more than 80°F in the watershed's lower elevations.

2.3. Flood History

2.3.1. Milk River

Historical accounts of flooding in the Milk River basin date back to the late 1800s. Based on a 1932 congressional report, 72 floods occurred during the span from 1880 to 1931 (FEMA, 2006). Many were reported to be the result of rapid spring snowmelt, with some additional peak flows resulting from heavy intense rainfall between May and September and some instances of rain combined with snowmelt during March and April. Ice jams that form during the spring runoff can increase the severity of the localized flooding by increasing stage. A separate report details the location, occurrence and magnitude of ice jams in the Milk River corridor (Michael Baker, 2020).

Floods are often described with reference to a peak discharge or flow rate. The highest rate of flow to occur during a flood event is only one metric of the overall impact of a flood event. The duration of flooding, the volume of total runoff during the event, the height to which the water rises and the extents the runoff reaches in the floodplain are also factors that can vary with each flood. For example, a rainfall driven flood with a peak discharge of 10,000 cfs that lasts three days in summer could have drastically different impacts on the river and floodplain than a slow spring melt flood with the same peak discharge that takes place over three weeks, and is subjected to ice jams and reduced floodplain conveyance from snow and frozen soils. Thus, the anecdotal history provided below may not always include estimates of peak discharge, however, other observations lend important insight into the extent of damage, duration, and communities affected by these events.

2.3.1.1   Anecdotal Information

There are numerous anecdotal accounts of flooding, many of which are available in historic newspaper articles. The earliest known flood in the valley occurred prior to 1880, before the valley was settled or the railroad was built. Many of the newspaper articles focus on flooding in Glasgow, prior to the construction of the levee constructed in 1911 to protect the city from flood waters. Additional information is summarized in county and state documents.

The following accounts pertaining to the Milk River have been summarized from the existing Phillips, Blaine and Hill Flood Insurance Studies (FEMA, 1987, 1988, 2006).

Pre-1900: The first significant flood known to have occurred in the Milk River basin was in 1880, before the valley was settled and before the Great Northern Railroad had been built. Another great flood occurred in March 1888, due to melting snow. At the time, the Great Northern Railroad was the only transportation route through northern Montana. The GNRR suffered much damage to culverts and bridges, thus limiting the railway transportation. In April 1899, another great flood caused by rapid snowmelt occurred. Little engineering data are available on these three historic floods since observations of stage were not recorded or preserved.

1906: The first flood for which factual data are available occurred in June 1906, due to rains that had started in mid-May. During a 3-week period, an average of 5 inches of rain fell on the basin. On June 6, an intense storm began in the vicinity of Highwood. Moving northeasterly, the storm centered over a small area near Warrick, in the Bear Paw Mountains dropping 8.26 inches of rainfall on June 7. The rainstorm is the greatest of record in the Milk River valley. The valley was flooded from Havre to the mouth of the river. At that time, gaging stations existed on the South Fork Milk River at the international boundary, Milk River at Havre, and Milk River at Malta. The Milk River at Malta gage recorded a discharge of 11,200 cfs, the fourth highest to date.

1907: Serious floods occurred in early April 1907 when a back to back yearly flood occurred. A discharge of 11,400 cfs was recorded at Malta on April 10, the third highest to date. The 1907 flood was the result of snowmelt.

1908: Phenomenal rains west of Havre produced high flows in June 1908 on the Milk River above Havre. A peak flow of 15,000 cfs was estimated for the South Fork of the Milk River near the Canadian boundary, with a drainage area of only 288 square miles. Extremely high floods occurred in the Marias and adjacent basins west of the Milk River drainage basin during the same 1908 storm.

1912: During April 1912, a great flood occurred when warm weather melted snow which had been saturated by heavy fall rains. Rainfall accompanied the flood, amounting to slightly more than 1 inch in 3 days. Except for April rainfall, the 1912 flood appears to have been produced by conditions like those existing in 1952 (the current flood of record in most locations on the Milk River).

1917: April 1917 produced a major flood from Eastern Crossing to the mouth, due to rapid snowmelt. Record flows, which were not exceeded until 1952, occurred on the Milk River near Hinsdale. Near maximum flows also occurred on the Milk River at Havre and Malta during the same snowmelt peak runoff event.

1918: Another major back to back year snowmelt flood occurred in March 1918. Peak discharges, which were only exceeded in 1952, occurred on the Milk River at Havre and Malta.

1923: Following a 9-day storm during June 15 – 23, a destructive flood occurred in the lower Milk River valley. Slow, steady rain fell over the entire basin during the first days of the storm, followed by heavy, intense rainstorms along the main river valley. The storm path progressed downstream and although the total average rainfall was less than 4 inches, exceptionally high runoff rates occurred during the intense part of the storm due to saturation of the soil during the early storm period and concentration of peak flows caused by the direction the storm traveled. Flood conditions prevailed throughout the basin, although no record flows were established.

1927: A severe rainstorm occurred in May 1927, starting on May 17, and continuing with major precipitation on May 28 and 29. The storm produced an average of 5 inches over the Milk River Basin. Flood conditions were produced from Eastern Crossing to the mouth. This rain flood followed about a month of severe snowmelt floods.

1938: A cloudburst-type storm centered over the Bear Paw Mountains on June 22, 1938, producing over 5 inches of rainfall. Havre recorded 1.20 inches in 30 minutes. Nine persons lost their lives.

1952: The flood of April 1952 in the Milk River remains the flood of record. The event was caused by a combination of meteorological factors that were favorable for above-normal runoff in a short time. The soil cover was impervious at the time of the flood as a result of the cold, wet autumn of 1951 and a February thaw that placed an ice layer on the frozen topsoil, which remained impervious until the spring snowmelt was complete. Snow accumulated in above-normal amounts throughout the basin during the winter. The rapid rise in temperature coupled with warm chinook winds from late March into April produced snowmelt that resulted in record peak discharges at all gaging stations on the Milk River from Havre to the mouth. The peak discharge at Malta during this event was 24,000 cfs. The flood in the Milk River basin occurred in two surges: the first brought early flooding at Havre and other cities along the Milk River; the second represented the arrival of floodwaters from the most distant drainages in Canada, Battle Creek and Frenchman River. Progress of the Milk River mainstream flood was slow in comparison to most Montana floods.

Transportation in the Milk River valley was possible only by rail or by boat during the flood crest. The Great Northern Railroad was not overtopped in any place along the main line through the Milk River valley and at many cities and towns the railroad embankment served as part of the protective dike system.

Photo 1. Milk River flooding near Glasgow, April 17, 1952 (Glasgow Courier, 1952)

1953: Water supply paper 1320-B indicates that for the second consecutive year the Milk River flooded. Flooding north of Havre occurred on June 6, 1953, as dikes along the Milk River broke and floodwater backed up from downstream.

1978: Above average temperatures in the 60° F range in early April released a heavy snowpack in the Milk River basin, which contributed to a major flood problem. Flooding between Malta and the mouth of the Milk River persisted for over a week as residents from Dodson to Malta were evacuated from their homes. Peak flows during this flood reached stages close to those experienced in the 1952 flood although discharges were considerably less.

The following information is derived from the Draft 2018 Multi Hazard Mitigation Plan for Blaine County.

1986: In 1986, a 500-year+ flood occurred, damaging over half of the homes in Harlem. The Fort Belknap Indian Reservation experienced flooding in the past along stretches of the Milk River, including a bad year in the early 1990s.

2011: Rising stream and river levels led to lowland flooding and road and other infrastructure damage. Fort Belknap Indian Reservation experienced flooding in its northeastern portion. Families were displaced several times by rising water. A storm also caused flooding in Hays and Lodge Pole and rising levels of the Milk River displaced several more families who live in the river valley near the Fort Belknap Agency. The NWS Milk River near Glasgow gage peaked at 34.08 ft on June 11, the highest crest on record, 3.08 ft above major flood stage.

2013: Two weeks of rain dropped between what would normally be half - or more - of the total amount of rain that falls in a year. The flooding was a flashback to 2011, when rain and melting snow drenched the area, leading to local, state and federal disaster declarations, and 2010, when the flooding also led to presidential disaster declarations for Hill County. Roads, culverts, bridges, water systems and government buildings all were damaged in the flooding.

April 2018: Flooding resulted in a state of emergency declaration Blaine and Hill counties and the Fort Belknap Indian Reservation. Water released from Fresno Reservoir gushed into the Milk River as more water ran over the spillway at the dam. Melting snow filled the dam and flooded the region, damaging roads and inundating fields.

Photo 2. Milk River flowed over highways heading south out of Chinook, April 25, 2018 (Blaine County Journal, 2018)

2019: Flooding of the Milk River resulted from snowmelt coupled with additional snowfall and rain resulted in the Milk River reaching a major flood stage.
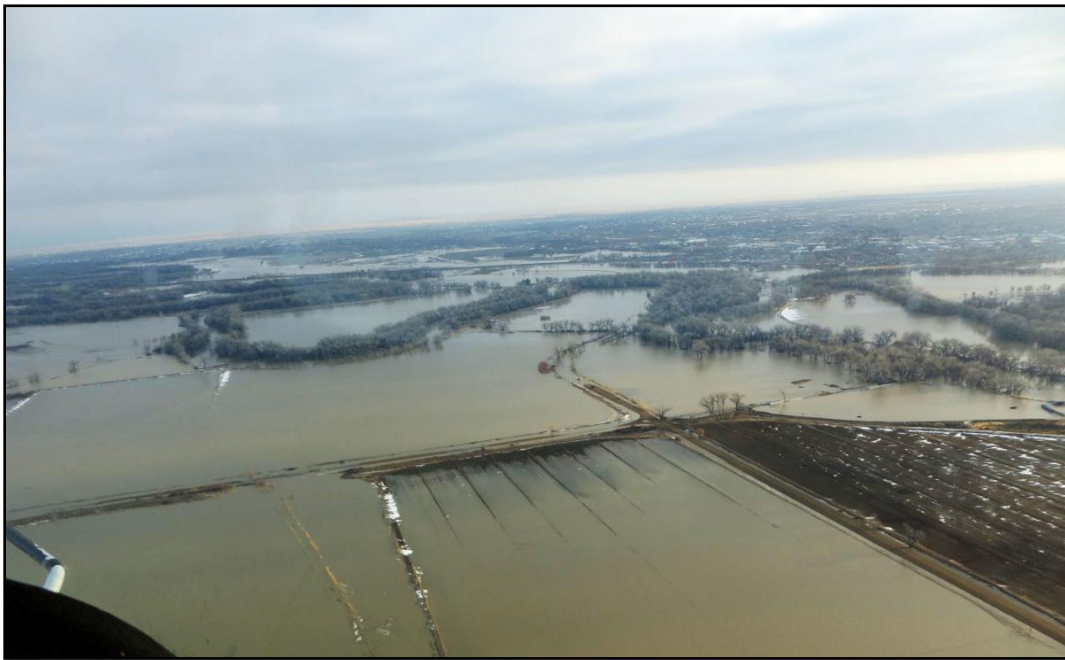
Photo 3. Aerial view of Milk River flooding near Glasgow, March 27, 2019 (Billings Gazette, 2019)

2.3.1.2   Recorded Data – Milk River Mainstem

The USGS currently operates (and has historically operated) numerous gaging stations within the Milk River watershed along the Milk River corridor and select tributaries to the Milk River. Under an agreement with DNRC, USGS performed flood frequency analyses of select gages within the Milk River watershed with the intent of using the revised flood frequency results in hydraulic analyses and subsequent revisions to floodplain mapping within the watershed. The results of these analyses are presented in the following sections. The largest recorded discharge events for six of the gages representing the span of the river from below the Fresno Reservoir (Milk River at Havre) to the confluence with the Missouri River (Milk River at Nashua) are presented in **Table 3**. **Figures 16 through 21** indicate peak flow events used in this analysis along the mainstem Milk River, and include peak flows directly measured at those gages and those used in record extension (MOVE.3) methodologies.

Table 3

Table 3. Peak flow data for select gages on the Milk River

Milk River						
Station Name	Milk River at Havre		Milk River near Harlem		Milk River near Dodson	
Station Number	06140500		06154100		06155030	
Period of Peak Flow Data	1900-2018		1939-2018		1983-2018	
Number of Peak Flow Records	66		48		41	
	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
Largest Recorded Events	4/03/1952	11,400	Historic	19,000	9/26/1986	13,200
	4/19/2018	8,230	9/29/1986	13,900	4/23/2018	10,700
	3/31/1978	7,840	Historic	9,800	5/23/2011	8,550
	3/07/1994	7,600	4/22/2018	8,970	6/05/2013	8,540
	6/06/1953	6,900	4/19/1965	6,600	8/26/2014	6,530
Milk River						
Station Name	Milk River at Juneberg Bridge near Saco		Milk River at Tampico		Milk River near Nashua	
Station Number	0615410		06172310		06174500	
Period of Peak Flow Data	1978-2018		1953-2018		1899-2018	
Number of Peak Flow Records	41		67		101	

	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
Largest Recorded Events	4/03/1978	12,400	4/17/1952	45,000	4/18/1952	45,300
	4/29/2018	11,500	4/01/1925	27,200	6/09/2011	26,500
	10/01/1986	11,400	4/11/1917	25,200	4/05/1978	18,900
	3/29/1997	11,400	3/28/1918	24,900	3/08/1986	18,500
	3/04/1986	10,500	3/25/1939	21,100	4/02/1943	17,400

Figure 16. USGS 06140500 Milk River at Havre
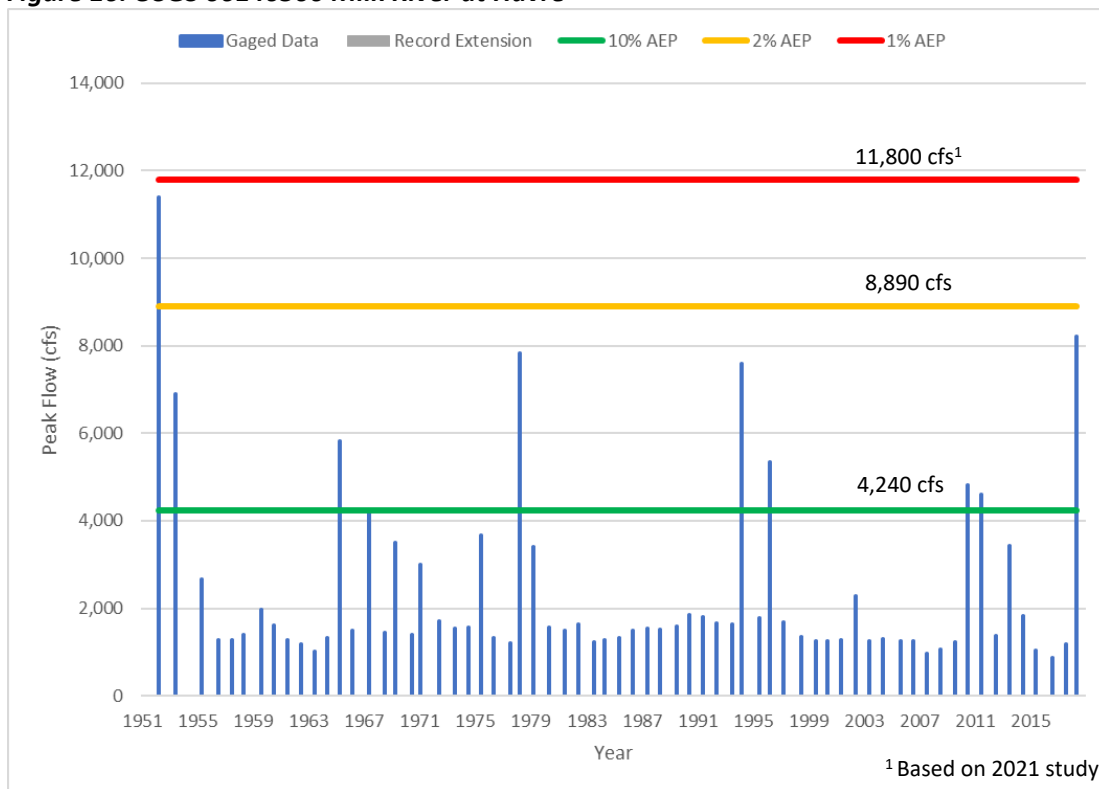
Figure 17. USGS 06154100 Milk River at Harlem
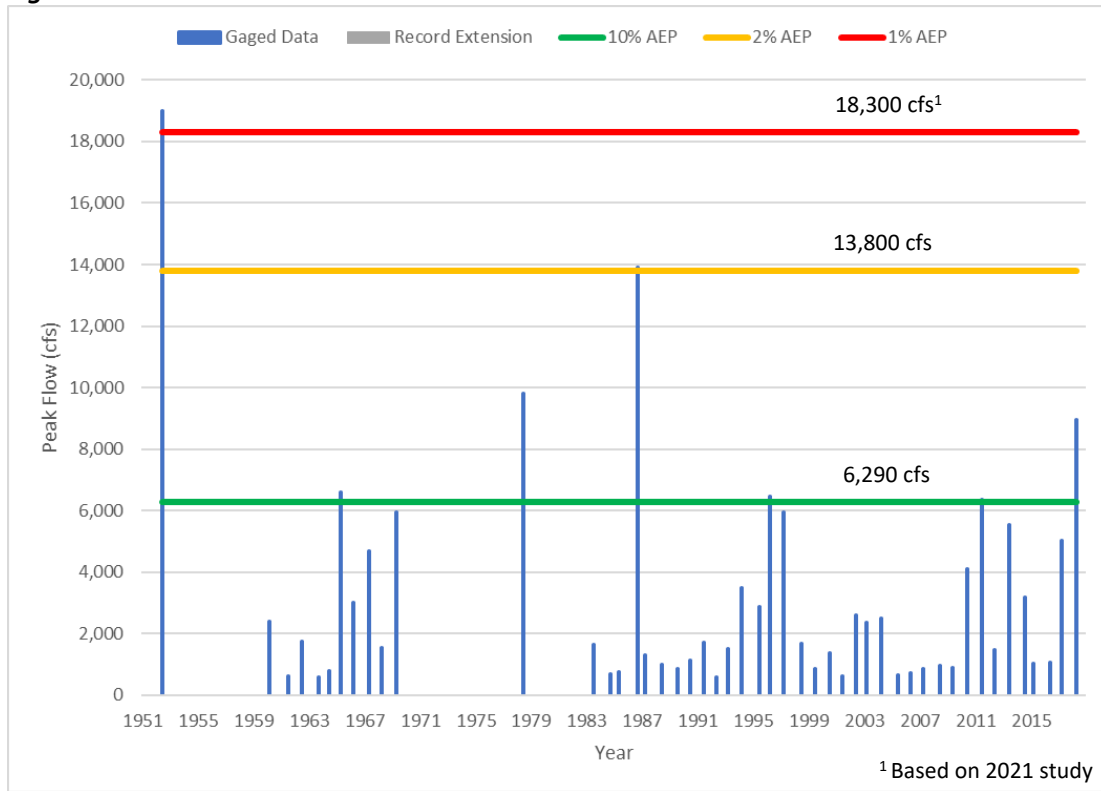
Figure 18. USGS 06155030 Milk River near Dodson
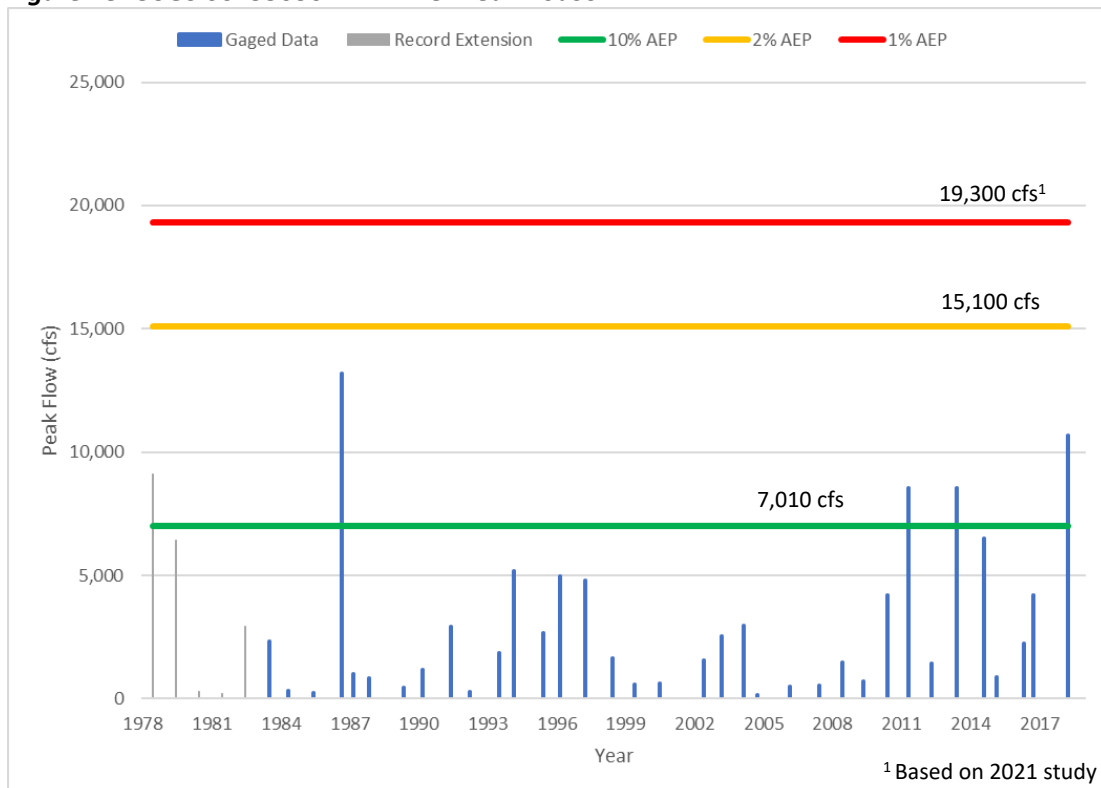
Figure 19. USGS 0614510 Milk River at Juneberg Bridge near Saco
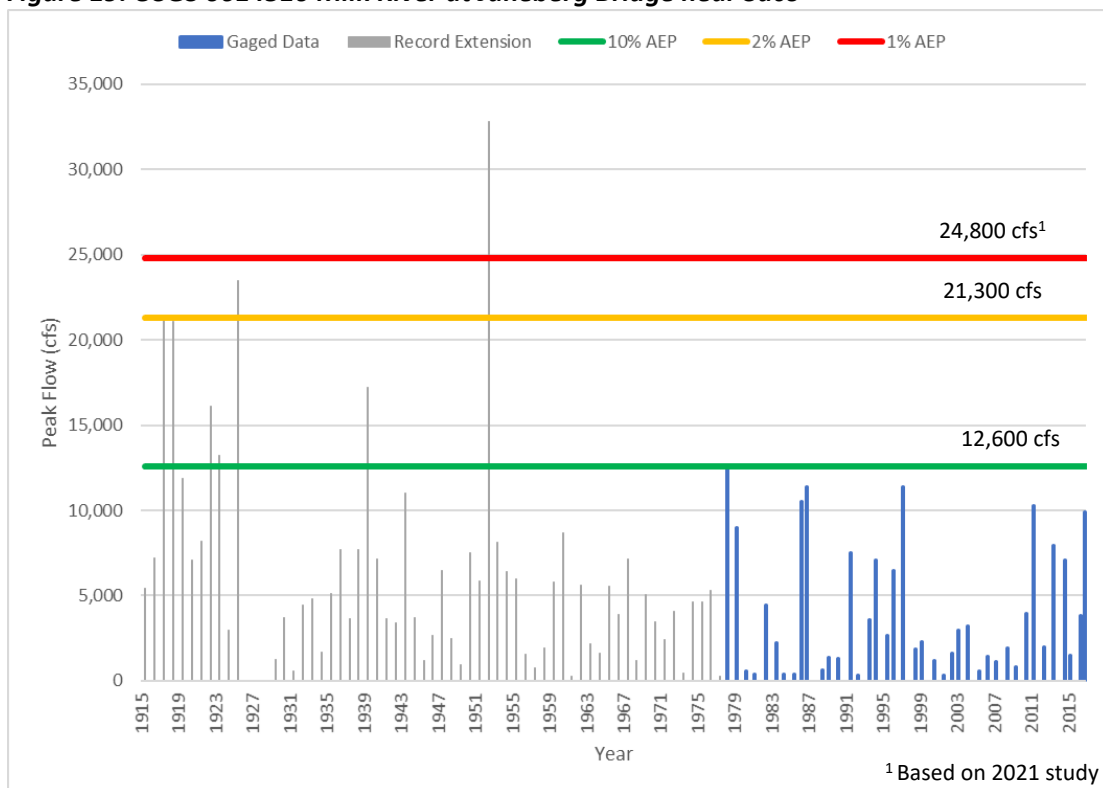
Figure 20. USGS 06172310 Milk River at Tampico
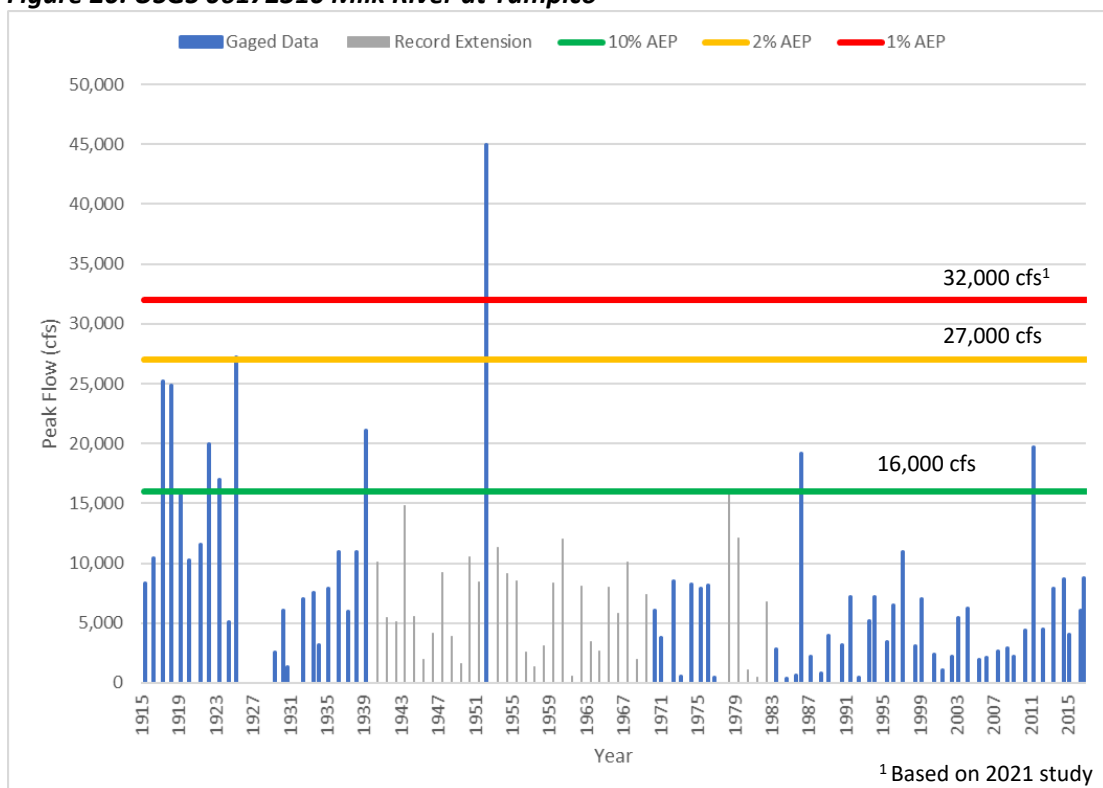
Figure 21. USGS 06174500 Milk River at Nashua
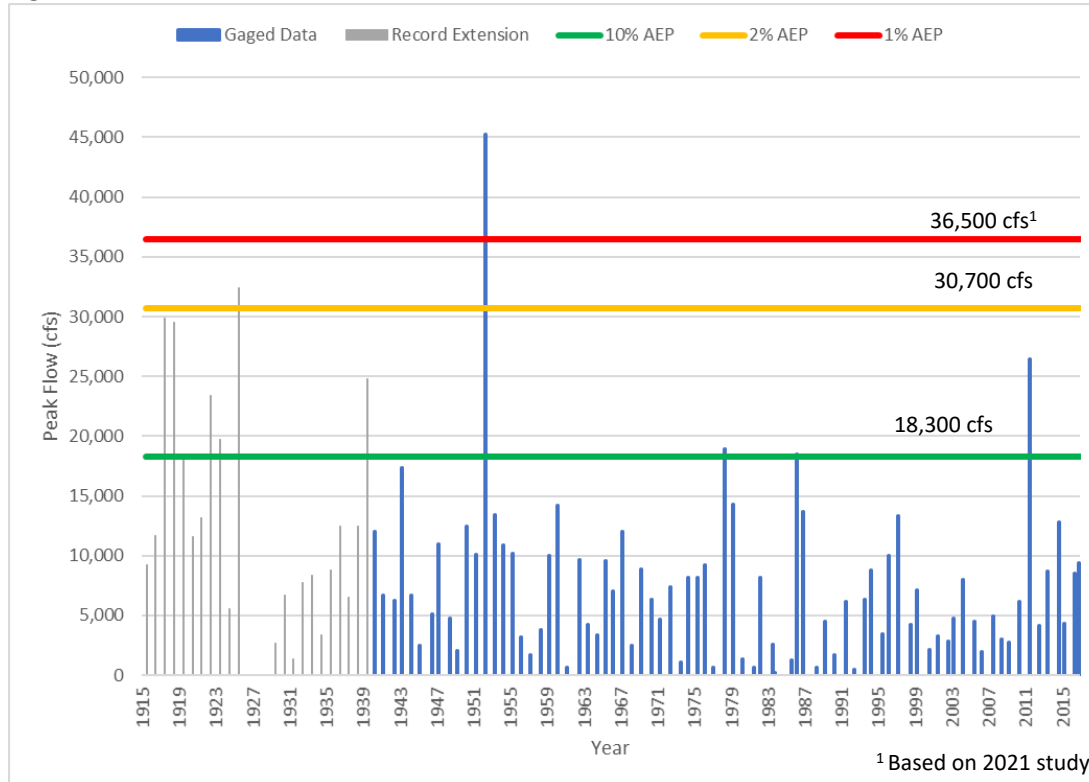
2.3.2. Milk River Tributaries

The tributaries of the Milk River vary in size, orientation, soil composition, land use and elevation. The predominant flood drivers for the contributing basins are not always coincidental with those of the Milk River or even other tributaries. The tributaries located further west in the system are more prone to flooding due to spring snowmelt, while the tributaries in the eastern portion of the system can experience floods due to thunderstorm bursts and heavy summer rains.

For example, the South Fork Spring Coulee near Havre, has 17 out of 18 peak flows that occurred between January and March, while Porcupine Creek near Nashua has 6 out of 15 peak flows that occurred between late June and late August. The following sections describe floods that have occurred based on anecdotal accounts and those documented by recorded peak flow data.

2.3.2.1 Anecdotal Data

Flooding of the numerous tributaries in the Milk River valley is not as extensively documented as the main channel, primarily due to the less dense population that lives along the smaller streams. However, information is available in the existing Phillips, Blaine and Hill Flood Insurance Studies, through State and Federal Disaster Emergency databases, and current and historical news articles as summarized below.

1906: The first flood for which factual data are available occurred in June 1906, resulting from rains that had started in mid-May. Gaging stations existed on Battle Creek near Chinook, Beaver Creek

near Saco and Rock Creek near Hinsdale. Peak flows, which until 1952 had not been exceeded, were established for the latter two stations.

On several small tributaries phenomenal discharges were estimated, notably 8,600 cfs from 16 mi^2 on Lenoir Coulee south of Malta, 1,700 cfs from 25 mi^2 on Second Creek in the same vicinity, 1,606 cfs from 40 mi^2 on Fifteenmile Creek near Chinook, 1,750 cfs from 26 mi^2 on Threemile Creek near Chinook, and 2,750 cfs from 20 mi^2 on Wayne Creek near Harlem.

1912: During April 1912, extreme flooding occurred when warm weather melted snow which had been saturated by heavy fall rains. Rainfall added to the rapidly melting saturated snow, with more than 1 inch of rain falling in 3 days. Except for April rainfall, the 1912 flood appears to have been produced by conditions like those existing in 1952.

In 1912, Lodge Creek at the International boundary had a maximum discharge of 5,700 cfs which was 18 percent above the 1952 peak. The 1912 flood peak on Rock Creek near Hinsdale reached 10,000 cfs and was exceeded only by 18,000 cfs in 1906 and 12,900 cfs in 1952.

1917: April 1917 produced a major flood from Eastern Crossing to the mouth, as a result of rapid snowmelt. Record flows, which were not exceeded until 1952 were established for Battle Creek at the international boundary, Beaver Creek near Malta, and Frenchman Creek above East End.

1918: A major snowmelt flood occurred in March 1918. The peak discharge, which was only exceeded in 1952, occurred on Big Sandy Creek near Laredo. Battle Creek near Chinook had a discharge of 12,000 cfs, which has never been exceeded.

1923: A destructive flood in the lower Milk River valley occurred in June 1923 resulting from a 9-day storm during June 15-23. Flood conditions prevailed throughout the basin, although no record flows were established.

1925: During March 1925, rapid snowmelt produced severe flooding on Frenchman and Rock Creeks with unusually high water in Battle Creek, Lodge Creek, and other northern tributaries. The highest discharge recorded prior to 1952 occurred on Rock Creek below Horse Creek at the international boundary.

1938: A cloudburst-type storm centered over the Bear Paw Mountains on June 22, 1938, producing over 5 inches of rainfall. Havre recorded 1.20 inches in 30 minutes. Devastating floods were produced on Bull Hook Creek, and on Gravelly Coulee, 23 miles southwest of Havre. Nine persons lost their lives during this destructive flooding event.

1943: A severe snowmelt flood occurred in March 1942, producing record peaks on generally the same tributaries which flooded in 1925. The peak discharge on Lodge Creek below McRae Coulee of 6,090 cfs exceeded the 1952 peak by 10 percent. Maximum discharges were observed on Frenchman Creek at Morrison and below Val Marie and on Whitewater Creek at the international boundary. None of these flows were exceeded until 1952.

1952: During the floods of April 1952 nearly every tributary experienced a record peak flow of values close to the maximum. The flood in the Milk River basin occurred in two surges: the first brought early flooding at Havre and other cities along the Milk River; the second represented the arrival of floodwaters from the most distant drainages in Canada, Battle Creek and Frenchman Creek.

Thirtymile Creek caused most of the flooding at Harlem, although the Milk River was backed up nearly to town. Flooding at Dodson resulted from backwater from the Milk River and overflow from Dodson Creek.

Frenchman Dam on Frenchman Creek failed at approximately 5:00 pm on April 15, 1952 followed by the washout of the spillway structure the following day. The failure of the dam coupled with inflow from Rock Creek and other tributaries created the flood of record on the Milk River at Glasgow on April 18, 1952.
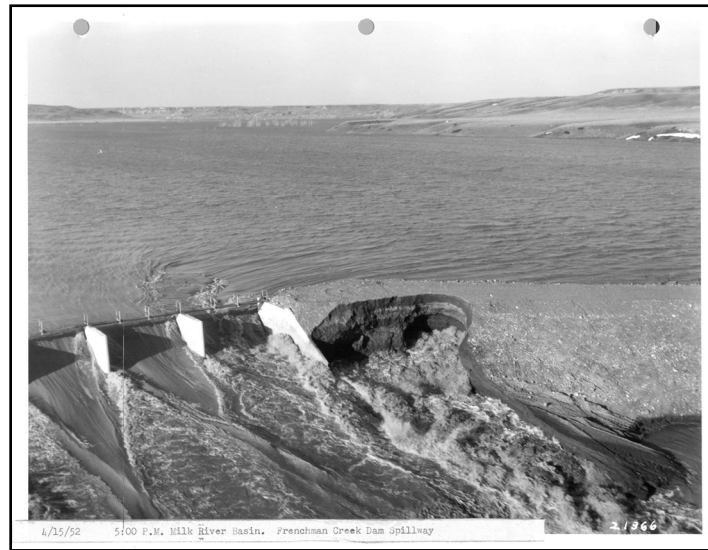
Photo 4. Failure of Dam on Frenchman Creek, April 15, 1952 (US NWS, 2016)

Photo 5. Frenchman Dam failure April 16, 1952 (US NWS, 2016)

1972: Heavy rains were reported across the valley with several tributaries flooding as seen in Photo 6 of Cherry Creek.

Photo 6. Cherry Creek west of Glasgow, June 15, 1972 (USDA, 1984).

1986: Fall rains resulted in flooding of most tributaries in the Glasgow area. Willow Creek washed out a county road south of Glasgow in October.

2011: Flooding occurred throughout the four counties, from March through April. Ice jams and frozen topsoil contributed to the stage and expanse of flood waters.

2013: A federal disaster declaration was made for damages due to flooding which took place between May 19 and June 3, 2013. Damages occurred in Blaine, Hill and Valley counties.

2018: Flooding that occurred in the state from April 12 to June 15, resulted in a request for a major disaster declaration (later granted in August 2018). Damages due to flooding occurred in Blaine, Hill, and Valley Counties.

2019: Flooding from the period of March 20 to April 10, 2019 led to a presidential declaration of a major disaster in Valley County. No residences were reported to be impacted.

2.3.2.2   Recorded Data

There are 13 USGS gaging stations on the mainstem Milk River, and another 48 USGS gages located on 40 tributaries of the Milk River. The ten largest tributaries (by drainage area size) are listed in **Table 4** with their 5 highest recorded peak flows. While the 1952 and 1986 floods set most of the records at the USGS gages on the main stem of the Milk River, the tributaries do not necessarily follow the same pattern as evidenced by the peak flow dates.

Table 4. Peak flow data for select tributary gages in the Milk River watershed

Tributaries to the Milk River					
Station Name (Drainge Area)	Big Sandy Creek near Havre (1,787 mi²)		Battle Creek near Chinook (1,468 mi²)		Fifteenmile Creek trib near Zurich (1.7 mi²)	
Station Number	06139500		06151500		06153400	
Period of Peak Flow Data	1946-1953, 1955-1967, 1969, 1978, 1984-2018		1905-1914, 1916-1921, 1952, 1984-2018		1974-2018	
Number of Peak Flow Records	58		52		45	
Largest Recorded Events	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
	03/30/1978	6,000.	06/08/1906	11,000.	09/25/1986	1,250.
	04/03/1952	5,570.	03/31/1918	10,800.	04/21/2018	77.
	04/18/2018	4,300.	04/10/1917	7,800.	03/29/1978	70.
	04/12/1965	2,950.	06/21/1909	6,650.	07/10/1983	64.
	1969	2,600.	04/08/1912	6,650.	08/12/2002	63.

Milk River Watershed Hydrologic Analysis: Volume 2

Tributaries to the Milk River					
Station Name (Drainge Area)	Peoples Creek below Kuhr Coulee near Dodson (688 mi^2)		Beaver Creek near Hinsdale (1,678 mi^2)		Unger Coulee near Vandalia (10 mi^2)
Station Number	06154550		06167500		06172300
Period of Peak Flow Data	1906, 1952-1966, 1968-1973, 1982-2009		1912, 1919-1921, 2005-2018		1958-2018
Number of Peak Flow Records	50		18		61
Largest Recorded Events	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
	09/25/1986	7,590.	06/09/2011	8,210.	06/09/1972	4,460.
	06/07/1906	4,500.	10/05/2016	6,350.	07/05/1979	3,450.
	06/09/1972	3,940.	08/25/2014	5,830.	05/25/2010	636.
	03/30/1952	3,500.	04/18/2018	5,740.	07/14/1962	575.
	04/11/1965	3,360.	04/06/1912	4,630.	06/07/2011	542.

Tributaries to the Milk River					
Station Name (Drainge Area)	Frenchman Creek at International Boundary (1,960 mi^2)		Willow Creek near Glasgow (531 mi^2)		Porcupine Creek at Nashua (724 mi^2)
Station Number	06164000		06174000		06175000
Period of Peak Flow Data	1917-2018		1954-1987, 1993		1909-1921, 1923-1924, 1939, 1954, 1982-1993
Number of Peak Flow Records	102		35		29
Largest Recorded Events	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)		
	04/15/1952	22,700.	07/14/1962	12,400.	1954	15,300.
	03/27/1997	8,370.	07/07/1969	12,000.	04/13/1982	6,600.
	03/30/1943	6,630.	06/21/1974	8,890.	03/06/1986	3,000.
	03/29/1925	5,440.	05/06/1965	5,220.	04/11/1916	2,700.
	03/25/1928	4,950.	03/20/1960	5,050.	08/20/1912	2,390.

In additional to the discharge information available from the USGS, the National Weather Service (NWS) in Glasgow, MT also has gage data that is available on the website. Gages operated by NWS report stage data. Additional information about the gage information operated by the NWS at Glasgow are included in **Section 5.0**. Information available for the reported tributaries of the Milk River are summarized in **Table 5**.

Table 5. Peak stage data for NWS tributary gages in the Milk River watershed

	Tributaries to the Milk River					
Station Name	Big Sandy Creek Near Havre		Battle Creek Near Chinook		Beaver Creek near Saco	
Station Number					GSCM8	
Action Stage / Flood Stage	10 ft / 12 ft		12 ft / 14 ft		9 ft / 11 ft	
Number of Peak Flow Records	57		50		13	
Largest Recorded Events	Date	Peak Stage(ft)	Date	Peak Stage(ft)	Date	Peak Stage(ft)
	03/30/1978	15.15	09/26/1986	22.91	09/26/1986	14.68
	04/03/1952	14.70	06/08/1906	16.63	10/07/2016	13.30
	04/19/2018	14.63	03/31/1918	16.50	03/24/2011	12.93
	06/06/2013	11.90	04/06/1952	15.38	04/06/2018	12.35
	04/12/1965	11.31	04/10/1917	13.10	08/28/2014	12.18
	Tributaries to the Milk River					
NWS Station Name	Beaver Creek near Hinsdale		Rock Creek Near Opheim		Frenchman Creek Near Intl Boundary	
Station Number	BCHM8		ORHM8		FREM8	
Action Stage / Flood Stage	12 ft / 14 ft		N/A		10 ft / 12 ft	
Number of Peak Flow Records	20		13		48	

	Date	Peak Stage(ft)	Date	Peak Stage(ft)	Date	Peak Stage(ft)
Largest Recorded Events	08/26/2014	19.52	03/28/1978	13.40	04/15/1952	19.90
	06/09/2011	19.44	04/07/1969	12.03	03/27/1997	17.62
	10/06/2016	18.50	03/29/1997	11.59	03/30/1943	16.36
	05/23/2011	18.12	04/12/2011	11.17	03/18/2017	15.51
	06/01/2011	18.10	04/06/1974	10.59	03/21/1976	15.49

3. Previous Studies

Various hydrologic studies have been conducted across the broader Milk River watershed, primarily flood-frequency analyses at select gaging stations or regression analyses at various ungaged locations.

The various sources of information are tied to previous FEMA flood insurance studies, other flood hazard studies, and data compiled by the USGS for stream gages within the watershed. A summary of the existing studies and documents are provided in the following sections.

3.1. Flood Insurance Studies

3.1.1. Blaine County

An original Flood Insurance Study (FIS) for Blaine County, Montana (All Jurisdictions) was published effective by FEMA on May 19, 1987 (FEMA 1987). An updated version of this FIS was effective on September 2006 (FEMA 2006).

The 1987 FIS was based on original hydrologic and hydraulic analyses performed on the Milk River and tributaries at or near the communities of Chinook, Zurich, and Harlem. Bulletin 17B flood-frequency analysis methods (IACWD, 1982) were applied at gaged sites, however the period of record for the flood-frequency analyses of gages on the Milk River below Fresno Dam only included peak flows after the dam was closed (1939) due to the attenuation the reservoir has on Milk River peak flows following completion of the dam. Although regional analysis equations developed by USGS (USGS 1981) were applicable for Milk River tributaries, an independent regression analysis was performed for the 1987 FIS based on 17 gaging stations within the immediate vicinity of the tributaries were developed based on contributing drainage areas and applied to the ungaged study areas. A USBR report on the Milk River flood of 1952 (USBR 1952) was used to evaluate and compare the results of the hydrologic analyses with actual flood data.

A restudy was completed with revised hydrologic and hydraulic analyses and incorporated into the 2006 FIS. The 2006 restudy was on reaches near the communities of Dodson, Hays, Harlem, Chinook, in unincorporated Blaine County, and at locations within the Fort Belknap Indian Reservation. The 2006 FIS used hydrologic results from a restudy of the mainstem Milk River and Tributaries using Bulletin 17B for gaged sites and USGS regional regression equations on ungaged tributaries.

3.1.2. Phillips County

Original Flood Insurance Studies (FIS's) for Philips County, Montana (City of Malta, Unincorporated Areas) was published effective by FEMA on May 19, 1987 (FEMA 1987). Peak flood-frequency relationships were developed using methods presented in Bulletin 17B, with records extending back prior to the closure of Fresno Dam (1939) truncated to reflect the attenuation effects of Fresno Reservoir. Regression equations based on the drainage area for the Milk River watershed between Havre and the confluence with the Missouri River were developed to estimate peak flood flows for ungaged locations on the Milk River in Phillips County between Havre and confluence with the Missouri River. A summary of hydrologic data from the 1952 flood are compiled in a USGS Water Supply Paper (USGS 1955). Information from this USGS Water Supply Paper were used to support the 1987 FIS.

3.1.3. Valley County

The effective FIS in Valley County (City of Nashua) was published effective June 4, 2007. This FIS is based on hydrologic analyses performed on Porcupine Creek derived from a 1993 USGS Water-Resources Investigation Report (Omang 1993). The 1993 USGS report performed flood-frequency analysis on the Porcupine Creek gage at Nashua using Bulletin 17B methodologies and modified using techniques presented in USGS Water-Resources Investigations Report (Omang 1992). The Blaine County FIS notes that the SCS completed a report on Milk River and Cherry Creek near Glasgow in 1984, however this report was not used in the Blaine County FIS nor is it referenced in the Valley County FIS.

3.1.4. Hill County

The effective FIS in Hill County (Town of Hingham and Unincorporated Areas) was published effective June 3, 1998. Hydrologic analysis for the Milk River were determined using flood-frequency analyses based on a USBR analysis for the design of Fresno Reservoir. Other gaged locations used flood-frequency analyses using Bulletin 17B. At an ungaged tributary to the Milk River, regional regression equations were utilized from a USGS Water-Resources Investigations Report (Omang *et al.*, 1986).

4. Hydrologic Analyses and Results

Hydrologic analyses were performed to identify the peak flow discharge estimates for flood events corresponding to the 10%, 4%, 2%, 1%, 0.2%, and 1% 'plus' annual exceedance probability (AEP) at specific locations on the mainstem and select tributaries to the Milk River. The select tributaries are those that will be studied using enhanced hydraulic study methods as part of this phase of the Milk River Watershed Study. Peak flow discharge estimates were performed by USGS for select stream gages on the Milk River and gaged tributaries within the Milk River watershed using Bulletin 17C methodology. For ungaged tributaries that will be studied using enhanced hydraulic study methods, the peak flow discharge estimates were determined using regional regression equations published by USGS (Sando, et al., 2018a). The locations for these calculations define flow change locations along the Milk River or tributary and generally corresponds to the junction of significant drainages or where

intermediate flow changes are required due to significant changes in contributing drainage area between confluences. The analyses conducted to identify hydrologic characteristics at these locations were performed using a regional regression equation approach to determine peak flows or applying gaged data to an ungaged location - either a drainage-area ratio adjustment or logarithmic interpolation between gages (USGS SIR 2015-5109-F (Sando, *et al.*, 2018b)).

As reported in Milk River Watershed Hydrologic Analysis Volume 1 – Tributaries and Water Bodies (Baker, 2020), the Milk River watershed is comprised of eight major sub-watersheds on the HUC-8 scale in addition to minor tributaries contributing directly to the Milk River mainstem. All eight of these sub-watersheds contain some of the approximately 900 studied reaches (using Base Level Engineering methods) in the watershed totaling over 2,100 miles. Contributing drainage basins were delineated for more than 2,000 flow change nodes with a little over 10% of these nodes representing closed basin waterbodies. This study (Volume 2), provides peak flow hydrologic characteristics for approximately 500 miles of mainstem Milk River (and about 14 miles of the Missouri River below Fort Peck Dam), along with 118 miles on 14 tributaries that will be studied using enhanced hydraulic methods. Bulletin 17C peak flow discharge analyses were performed on the mainstem Milk River gages and the gaged tributaries to the Milk River, as described in **Section 4.1**. Peak flow hydrologic characteristics for ungaged enhanced study reaches were analyzed using regional regression analysis, described in **Section 4.2.1**, and study reaches with gage data applied the gaged data to ungaged locations as described in **Sections 4.2.2 and 4.2.3**.

Bulletin 17C flood-frequency peak discharge analyses were deemed to be the most appropriate analyses for gaged sites, as they utilized actual flow data for that reach and for many sites record extension methodologies (MOVE.3) were able to be used to extend gage locations with relatively shorter periods of gage data to improve the representation of peak flows at the gage site. When possible, the Bulletin 17C flood frequency results were further improved by weighting the flood-frequency analyses with regional regression data. Weighting was generally applied if the gage site was unregulated and assessments of the gaged peak flow data were in agreement with the peak flow data used to generate the regional regression equations.

For the mainstem Milk River and tributaries containing one or more stream gages, the USGS Bulletin 17C flood-frequency analyses were coupled with methodologies to extrapolate or interpolate the gaged data to ungaged locations within the study reach using methodologies based on drainage-area ratios.

Regional regression analysis was selected as the best methodology to determine peak flows for tributaries without stream gages due to the relative accuracy and practical feasibility for the ungaged tributaries within the Milk River watershed. Two other approaches were considered and ultimately rejected: rainfall runoff modeling, and the Nallick runoff estimation approach (Nallick, 1994). Rainfall runoff modeling for the entire watershed was rejected due to its infeasibility at the scale of this study, and because the accuracy would not likely be significantly greater than regression analysis. The Nallick runoff estimation approach was rejected because it applies to only drainage areas less than one square mile. All of the ungaged tributaries in this analysis have drainage areas greater than one square mile.

All the methods described above rely on a delineation of the upstream contributing drainage area to each flow change node. As described in Milk River Watershed Hydrologic Analysis Volume 1, basin delineation, characteristics, and peak flow estimation are all available through the StreamStats web application (Sando, *et al.* 2016). Given the reliance of the equations on these delineations and the low resolution of the StreamStats elevation source (30-meters), the delineation results were checked and corrected using an independent method. A high-resolution stream network was defined based on a 15 ft digital elevation model (DEM), derived from LiDAR collected at a 3ft resolution. Nodes on the StreamStats flow network were assigned to the corresponding location on this new high-resolution network. The contributing drainage area to each node was then calculated using the ArcGIS Pro Hydrology Toolset. Outside of the area of LiDAR coverage, elevation data was supplemented with 10-meter DEMs in Montana (USGS, 2013a) and 0.75 arc-seconds (~20 meters) DEMs in Canada (Government of Canada, 2013). The Milk River Watershed Hydrologic Analysis Volume 1 provides a detailed description of how the contributing drainage areas for each node were compared between the two methods, and provides examples of locations where there was inconsistency between the two methods and how the drainage area results were revised to best represent the contributing drainage area to flow node locations. If the StreamStats delineations were inconsistent with the more accurate high-resolution elevation data, the StreamStats delineation was replaced by the revised sub-basin. An exception to this methodology was made for delineations that included closed basins. In these cases, the StreamStats results were typically accepted, barring no other major discrepancies from the high-resolution topography. Approximately 29 flow node locations were identified that required revisions to the StreamStats results.

4.1. USGS Stream Gage Analyses

Under an agreement with Montana DNRC, the USGS performed a peak-flow frequency analysis for select gages in the Milk River watershed. This analysis included gages throughout the watershed and has been published as a USGS data release (Siefken, *et al.* 2021). The gage analyses performed by USGS utilized methods described in a methods document prepared by USGS (Sando and McCarthy, 2018), and included at-station methodologies described in Bulletin 17C, the mixed-station record extension methodology Mixed-Station Maintenance of Variance Type 3 (MOVE.3), and regional regression equation weighting of at-station flood frequency analysis results. In general, gage stations were analyzed using the mixed-station record extension methodology Mixed-Station Maintenance of Variance Type 3 (MOVE.3) (those with short records, affected by flow regulation, or with large drainage areas (typically larger than 2,750 mi^2)). Details of how USGS applied the MOVE.3 analysis to synthesize peak flow data are provided in detail in Chapter D of Montana StreamStats (Sando, *et al.* 2018a) and summarized below. The MOVE.3 methodology is based on correlation of concurrent peak-flow records for the target station (station with incomplete flow records) with one or more index stations (stations with peak flow records for one or more of the missing years of the target station).   The procedure evaluates the strength of the relationship between peak discharges at target and index stations for the same year and adjusts the peaks for the index stations to fit the characteristics of the target station for the missing year data. Documentation regarding the application of the mixed-station MOVE.3 procedure is provided in the USGS data release (McCarthy, *et al.* 2018). For gaging stations where the MOVE.3 record extension was not appropriate, the sites

were evaluated to determine if weighting the at-station results with regional regression equations developed by USGS would be appropriate to better represent the peak-flow flood frequency results at those sites. **Appendix A** provides the results of the USGS flood frequency analyses and indicates those sites that had MOVE.3 record extension included in the analyses and those sites where the at-station results had regional regression weighting applied. **Figure 22** indicates how flows change along the Milk River based on drainage area within the watershed.

Figure 22. Annual Exceedance Probabilities for Milk River flow gages evaluated by this study
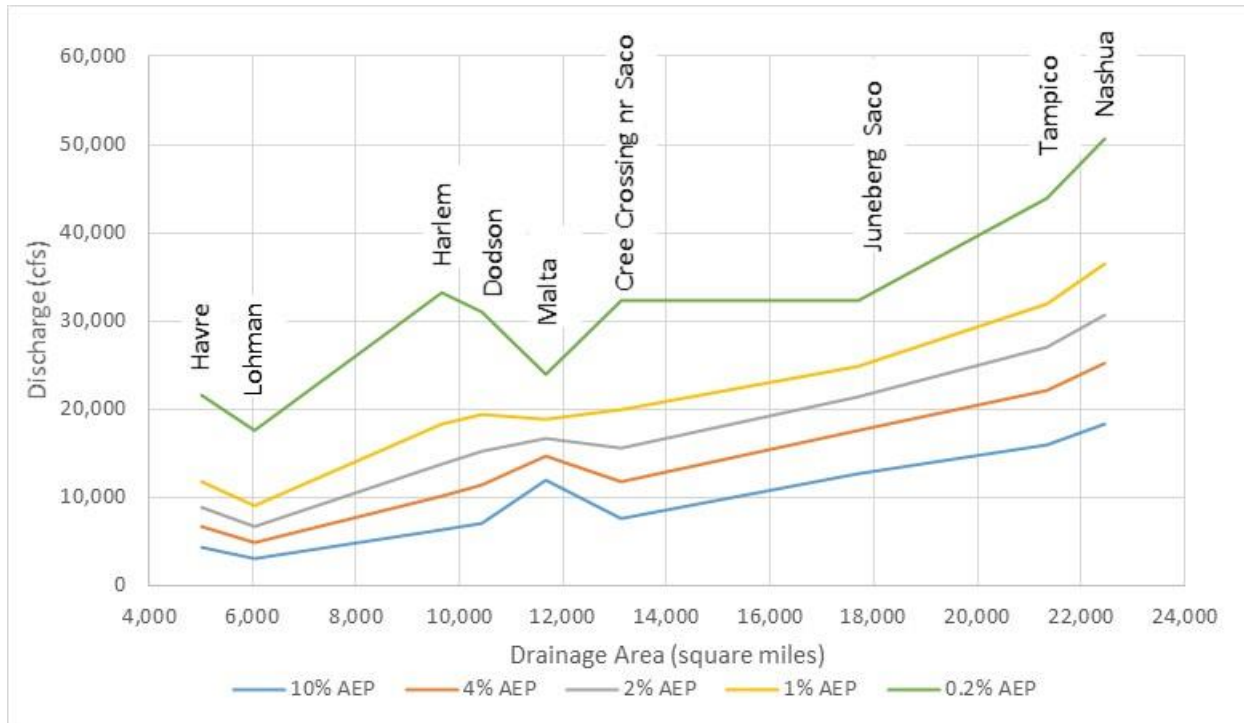
4.1.1. 1%+ Peak Flow Estimates – Gaged Peak-Flow Frequency Analyses

FEMA flood risk products employ a method for determining peak discharge estimates for a standard error of prediction above the 1% AEP, known as the 1% Plus discharge. The purpose of the 1% plus analysis is to represent uncertainty within the hydrologic evaluation and potential underestimations in the resulting modeled flood elevations by using the upper confidence limits (84%) to compute higher flood discharge (FEMA 2012). Baker staff reviewed supplemental information provided by USGS (Siefken, *et al.*, 2021) and incorporated the 1% plus results for the stream gages included in the USGS peak-flow flood frequency analyses.

4.1.2. Flow Change Node Locations

Flow change nodes typically fall into three types of placements throughout the study area. They were placed at the upstream extent of the enhanced study reach and at the downstream confluence of the study reach. In between the upper and lower extents, they occur when a significant tributary enters the study reach and created a significant increase in contributing drainage area or otherwise

influenced contributing watershed conditions such that a relatively large change in flows could be expected. HUC-12 watershed boundaries were utilized as a tool to evaluate potential locations where a flow change location might be warranted, but not all flow changes occurred at HUC-12 boundaries and not all HUC-12 boundaries resulted in a flow change location. The flow change nodes were spaced such that each node has provides a smooth flow transition from the adjacent upstream node.

4.2. Flood Frequency Estimates at Ungaged Sites

As previously described, a review of available peak-flow discharge data from gaging stations within the Milk River watershed on the mainstem Milk River and tributaries determined that refinement of hydrologic conditions along the study reach is required to properly represent changes in contributing drainage area and watershed characteristics along the study reach. For ungaged reaches, regional regression analyses were applied to the study reaches, and in many instances, multiple flow nodes were established along the study reach to better represent the changes in contributing drainage area and watershed conditions along the study reaches, so unreasonably large peak-flow values were not improperly applied to portions of the study reaches with significantly less contributing drainage areas. **Section 4.2.1** describes how regional regression equations were applied to ungaged study reaches.

There are 10 stream gages along the mainstem Milk River within the study area that the USGS performed peak-flow flood-frequency analyses on to determine the peak flow characteristics at those gage locations. However, these represent a relatively low density along the 500 mile four-county study area, where a number of significant tributaries and large changes in contributing drainage area occur between the gage sites. As a result, an assessment was performed of the gaged peak-flow discharge results at the gaged Milk River locations, and intermediate flow change locations were identified where more gradual changes in peak-flow discharge values can be reasonably expected to occur between gage sites. Generally, these flow change locations were placed to corresponded to junctions of significant tributaries that were known or expected to result in significant changes to flow values. HUC-12 watersheds were used as a tool to screen these locations, but not every HUC-12 watershed necessitated a flow change location, nor was every flow change location located at a HUC-12 boundary. In many instances, flow change locations where located in the immediate vicinity (upstream, downstream, or both) of a community along the Milk River to best represent flow conditions through the community. A total of 56 flow change locations were placed along the four-county, mainstem Milk River corridor study area. When a flow change location was located between two stream gages, the two-site logarithmic interpolation method (**Section 4.2.2**) was utilized to determine the peak-flow discharge conditions at the ungaged site.

On gaged Milk River tributaries with only one USGS stream gage, and on the mainstem Milk River above the uppermost stream gage or below the lowermost stream gage, the peak-flow discharge characteristics at ungaged flow node locations were determined by translating the gaged data to ungaged locations using drainage-area ratio adjustment (extrapolation). Four flow change locations on 3 gaged tributaries were identified and studied using this method.

4.2.1. Regional Regression Equations

The regional regression equation approach, developed by the U.S. Geological Survey (USGS) in cooperation with the Montana Department of Natural Resources and Conservation, was applied to the node locations to estimate peak-flow magnitudes associated with the 10, 4, 2, 1, and 0.2 percent annual exceedance probabilities. The methodology in this study relied on 537 gaging stations throughout the state of Montana that had a period of at least 10 years of systematic record, drainage area under 2,750 mi^2 and were unaffected by major regulation. Screening criteria also limited gages to those that were representative of peak-flow frequencies and included a redundant gaging-station analysis to account for spatial autocorrelation. An ordinary least squares regression was used in the study to adjust the boundaries between eight predetermined hydrologic regions. Final regression equations were developed for each hydrologic region using either generalized least squares regression or weighted least squares regression. The detailed methodology of regional regression analysis is described in Chapter F of Montana StreamStats (Sando, *et al.* 2018b).

The Milk River watershed spans four of the eight hydrologic regions in Montana (**Figure 23**) with most of the flow change nodes located in the Northeast Plains region. The mean standard error of prediction (SEP) for the 1% AEP discharges calculated by this method ranges from 54.5 percent in the Northeast Plains, to 73.5 percent in the East-Central Plains region. For the nodes where the basin delineation in StreamStats was accepted, peak flow estimates are retrieved directly from the web application. Calculating flows for the nodes that were replaced required obtaining the explanatory variables using the high-resolution spatial delineations. Contributing drainage area to each node is the one common explanatory variable in flow calculation across all regions with the other basin characteristics varying by region. The process of calculating other explanatory variables is outlined in **Section 4.1.2**.
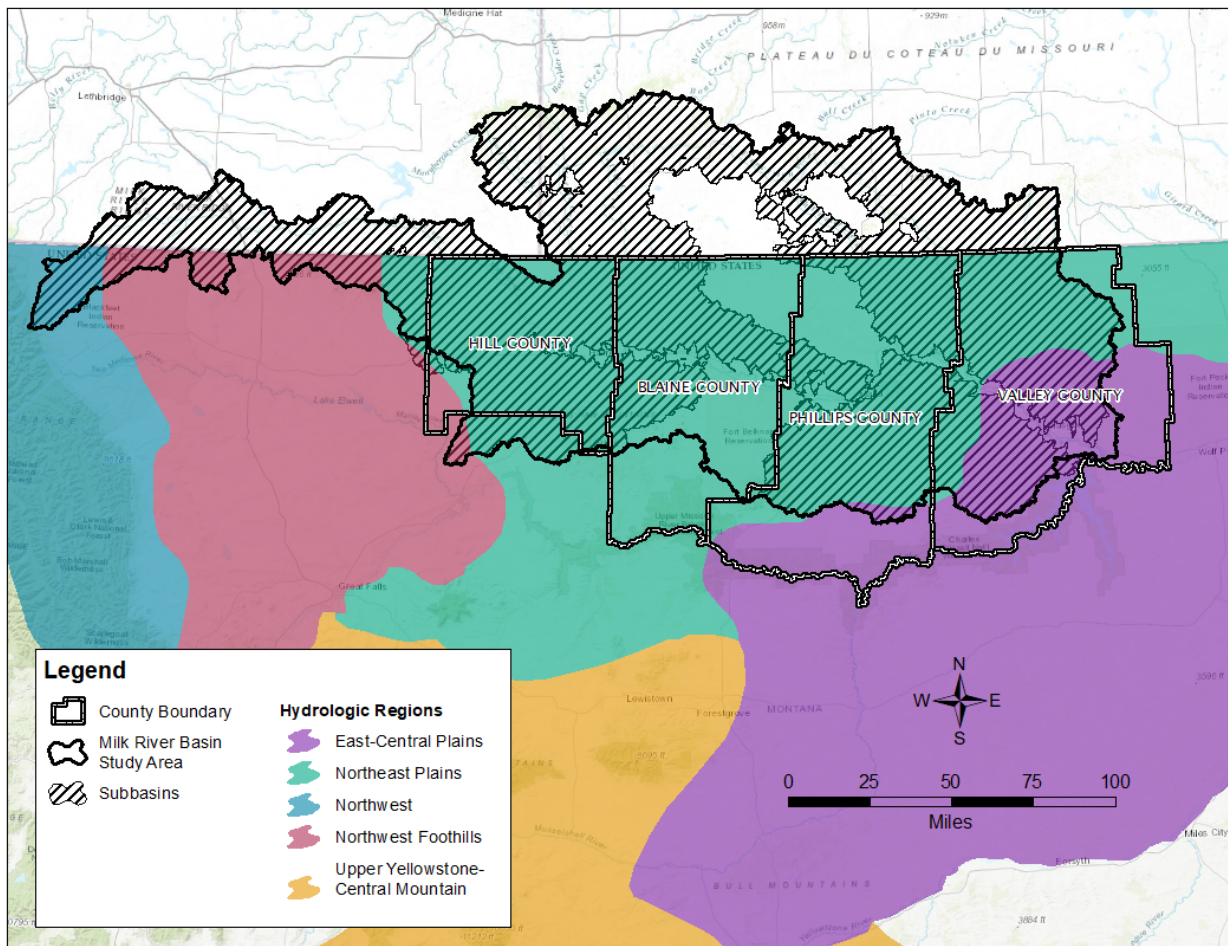
Figure 23: Montana Hydrologic Regions

In addition to the contributing drainage area, calculated as a feature of the basin polygons, there are other explanatory variables required for flow calculation across the study area. The elevation-based variables, percentage of basin above 5,000 feet elevation (E5000) and percentage of basin with slope greater than 30 percent (SLP30), were both calculated based on 30-meter DEMs (USGS, 2013b) utilizing the Spatial Analyst Toolbox in ArcGIS Pro. For the high-resolution basin delineations, these variable values were taken from corresponding StreamStats basin results.

When the contributing drainage area extended into Canada, hydrologic region boundaries were extrapolated to encompass the areas outside of defined zones. This was only necessary for a handful of basins that extended less than 2 miles across the border within the Northeast Plains region and is consistent with the regional regression document. Both the final discharge and the percentage of the basin area in each hydrologic region were reported.

The regression equations vary for each of the five estimated recurrence intervals, with a consistent set of explanatory variables maintained within each hydrologic region outlined in **Table 6** (Sando, *et*

al. 2018b). These equations were used to calculate the peak flow for all AEPs at all flow nodes on ungaged study reaches.

Table 6: Regression equations for estimating peak-flow at ungaged sites

REGRESSION EQUATIONS FOR ESTIMATING PEAK-FLOW AT UNGAGED SITES

Regression equation for indicated Q_{AEP}	Number of streamflow-gaging stations (n)[1]	σ_δ^2 (log units)	MVP (log units)	SEP (%)	SEM (%)	Pseudo or adjusted R^2 (%)
Northeast Plains hydrologic region[2]						
$Q_{10} = 62.5\,A^{0.617}\,(E_{5000} + 1)^{-0.231}$	64	0.042	0.047	53.1	49.8	90.2
$Q_4 = 121\,A^{0.594}\,(E_{5000} + 1)^{-0.262}$	64	0.036	0.041	49.2	45.5	90.6
$Q_2 = 181\,A^{0.579}\,(E_{5000} + 1)^{-0.280}$	64	0.037	0.043	50.7	46.6	89.4
$Q_1 = 257\,A^{0.565}\,(E_{5000} + 1)^{-0.292}$	64	0.042	0.049	54.5	50.0	87.4
$Q_{0.2} = 506\,A^{0.535}\,(E_{5000} + 1)^{-0.308}$	64	0.061	0.070	67.3	61.9	80.4
East-Central Plains hydrologic region[2]						
$Q_{10} = 178\,A^{0.489}\,(SLP_{30} + 1)^{0.214}\,ET_{SPR}^{-3.90}$	90	0.053	0.060	60.9	57.2	81.7
$Q_4 = 337\,A^{0.468}\,(SLP_{30} + 1)^{0.254}\,ET_{SPR}^{-3.65}$	90	0.056	0.063	62.7	58.5	79.5
$Q_2 = 497\,A^{0.454}\,(SLP_{30} + 1)^{0.279}\,ET_{SPR}^{-3.48}$	90	0.062	0.070	67.2	62.5	76.4
$Q_1 = 692\,A^{0.442}\,(SLP_{30} + 1)^{0.299}\,ET_{SPR}^{-3.32}$	90	0.072	0.082	73.5	68.3	72.4
$Q_{0.2} = 1{,}290\,A^{0.418}\,(SLP_{30} + 1)^{0.337}\,ET_{SPR}^{-2.98}$	90	0.105	0.118	93.1	86.2	61.3

[Q_{AEP}, peak-flow magnitude, in cubic feet per second, for annual exceedance probability (AEP) in percent; n, number of streamflow-gaging stations used in developing regression equations for indicated hydrologic region; σ_δ^2, model error variance; MVP, mean variance of prediction; SEP, mean standard error of prediction; SEM, mean standard error of model; Pseudo R^2, pseudo coefficient of determination presented for generalized least squares regression analysis; Adjusted R^2, adjusted coefficient of determination presented for weighted least squares regression analysis; A, contributing drainage area, in square miles; P, mean annual precipitation, in inches; E_{5000}, percentage of basin above 5,000 feet elevation; SLP_{30}, percentage of basin with slope greater than 30 percent; ET_{SPR}, Mean spring (March–June) evapotranspiration, in inches per month]

[1]The number of streamflow-gaging stations used in the $Q_{66.7}$ regression equation for a region might differ from the number of streamflow-gaging stations used in all other regression equations in that region because of streamflow-gaging stations with unreported $Q_{66.7}$ values (table 1–2; Sando et al. 2018b), which is discussed further in Sando *et al.*, 2018b.

[2]Regression equations were developed using generalized least squares regression analyses.

4.2.1.1 1%+ Peak Flow Estimates - Regional Regression Equations

In addition to the recurrence intervals described in **Section 4.2.1**, FEMA flood risk products employ a method for determining peak discharge estimates for a standard error of prediction above the 1% AEP, known as the 1% plus discharge. This 1% plus discharge was calculated by adding the associated mean Standard Error of Prediction (SEP) to the 1% discharge. This calculation was made for regional regression equations at nodes delineated by both methods, as the 1% plus discharge is not returned by the StreamStats web application (Sando *et al.*, 2018c).

4.2.2. Two-site Logarithmic Interpolation

At ungaged sites located between two gaging stations on the same river, Chapter F of USGS Scientific Investigations Report 2015-5019 (Sando, *et al.* 2018b) provides a methodology to estimate peak-flow frequencies using linear interpolation of the logarithms of peak-flow frequencies at the two gages using the logarithm of the drainage areas as the basis for the interpolation. The flow change locations between the two gaging stations on the mainstem Milk River utilize this methodology. The SIR cautions that this method may produce unreliable results if the two gaging stations have different peak flow characteristics caused by substantially different periods of records. The MOVE.3 analysis performed by USGS (Sando *et al.*, 2018c) minimizes the potential for this cause of unreliability given the record extension methodology. Results are presented in **Appendix A.**

Equation 2:

$$logQ_{AEP,U} = logQ_{AEP,G1} + \left[\frac{(logQ_{AEP,G2} - logQ_{AEP,G1})}{(logDA_{G2} - logDA_{G1})}\right](logDA_U - logDA_{G1})$$

where:

$Q_{AEP,U}$ is the AEP-percent peak flow at ungaged site U, in cubic feet per second;

$Q_{AEP,G1}$ is the AEP-percent peak flow for the upstream gaging station $G1$, in cubic feet per second;

$Q_{AEP,G2}$ is the AEP-percent peak flow at the downstream gaging station $G2$, in cubic feet per second;

DA_{G2} is the drainage area at the downstream gaging $G2$, in square miles;

DA_{G1} is the drainage area at the upstream gaging station $G1$, in square miles; and

D_{AU} is the drainage area at ungaged site U, in square miles.

4.2.3. Estimating Peak-Flow Frequencies at an Ungaged Site on a Gaged Stream

USGS SIR 20155019 Chapter F (Sando *et al.* 2018b) provides the methodology for estimating the peak-flow frequency when an ungaged site is close to a gaging station on the same river. The drainage-area ratio adjustment methodology is provided in Chapter F and is provided below. This method was utilized to estimate the peak-flow frequencies on gaged tributaries and mainstem Milk River. As noted in SIR 20155019, this method is appropriate for ungaged sites on large streams where regression equations are not applicable (e.g. drainage area out of the range of applicability), and results may not be reliable if the ratio of drainage areas (DA_U/DA_G) is outside the range of 0.5 to 1.5. All applications of this methodology on the ungaged sites on the mainstem Milk River and tributaries meet these criteria. Results are summarized in **Appendix A**.

Equation 1

$$Q_{AEP,U} = Q_{AEP,G}\left(\frac{DA_U}{DA_G}\right)^{exp_{AEP}}$$

Where:

$Q_{AEP,U}$ is the AEP-percent peak flow for ungaged site U, in cubic feet per second;

$Q_{AEP,G}$ is the AEP-percent peak flow for gaging station G, in cubic feet per second;

DA_U is the drainage area at ungaged site U, in square miles;

DA_G is the drainage area at gaging station G, in square miles;

exp_{AEP} is the regression coefficient for an OLS regression relating the log of the AEP-percent peak flow to the log of the drainage area within each location (SIR 20155019 Chapter F, Table 5).

4.3. Gaged/Ungaged Sites with Special Circumstances

Lodge Creek is the only tributary in this study which has a gaging station that was not used in the determination of the AEP flow values. The USGS Gage 06145500 Lodge Creek below McRae Creek at International Boundary is in the United States, just below the border with Canada and has a drainage area of 801 square miles. See **Figure 9**. Peak streamflow data is available from 1951 to 2018 with a total count of 67 peak flows. This gage is reported as having major dam regulation (where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area).

The enhanced study reach is located further downstream in the watershed with a contributing drainage area of 1,080 square miles near the confluence with the Milk River (approximately 35% increase in contributing area). The watershed between the USGS gage and the study reach is primarily comprised of agricultural development with associated minor ponding consistent with irrigation. This portion of the watershed is not considered to be highly regulated. A reduction in watershed regulation results in a reduction of attenuation of runoff with resulting higher peak discharge values.

In most cases, AEP flow values at ungaged locations of gaged streams can be determine using **Equation 1**. Recommended parameters include a drainage area ratio of gaged to ungaged drainage areas to be between 0.5 and 1.5. While the drainage areas at the study flow nodes on Lodge Creek (LC-0.1 and LC-7.6) and the USGS gage 06145500 fit within this range (ratio = 1.35), the changes in land use between the two locations call into question the applicability of the extrapolation method.

To further investigate this assumption, the next watershed to the east, Battle Creek (**Figure 24**), was evaluated. Battle Creek has two USGS gaging stations, one near the international boundary and a second closer to the confluence with the Milk River near Chinook. Similar to Lodge Creek, the gage at the international boundary is labeled as regulated with major dam regulation while that near Chinook is labeled as having minor dam regulation. A graph showing the relationship of the gage data and extrapolated data on Battle Creek for the 1% AEP demonstrates the disparity between the methods. The actual gage data is significantly higher than the calculated extrapolated value for the downstream location. The disparity is indicative of the impact on peaks flows due to the reduction in regulation in the watershed. (See **Figure 25**). The extrapolated estimate for Lodge Creek is also shown on the same graph as well as the value of the 1% AEP estimated using the RRE. The slope of the line for the RRE estimate on Lodge Creek is similar to that of Battle Creek and therefore assumed to provide more appropriate estimates of AEP values.

Figure 24. Lodge Creek and Battle Creek Watersheds
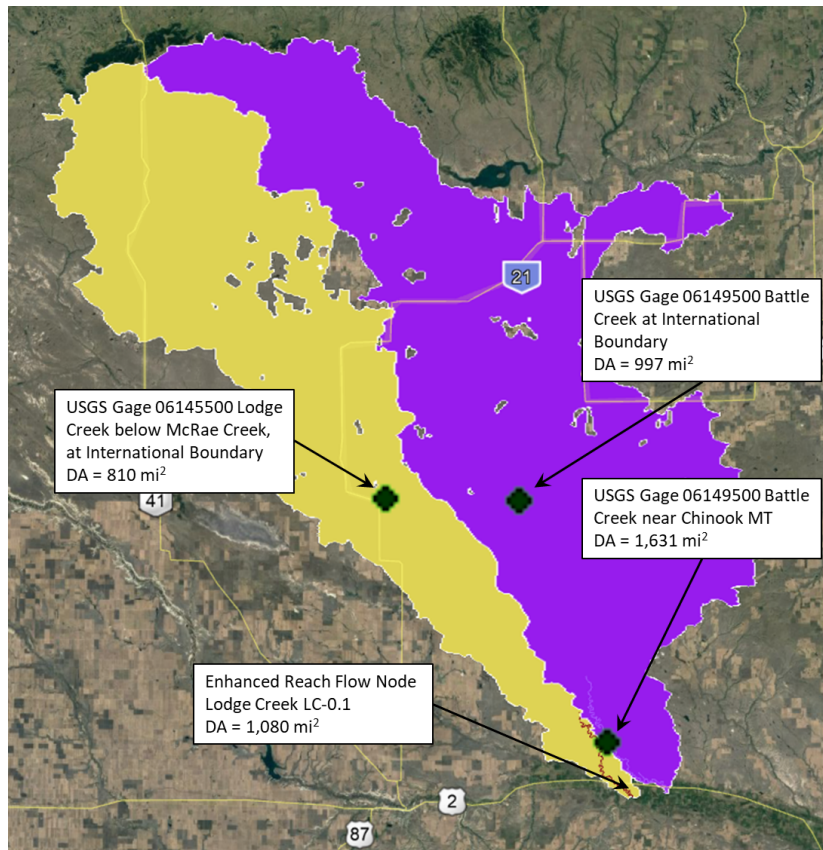
Figure 25. Lodge and Battle Creeks 1% AEP Evaluation
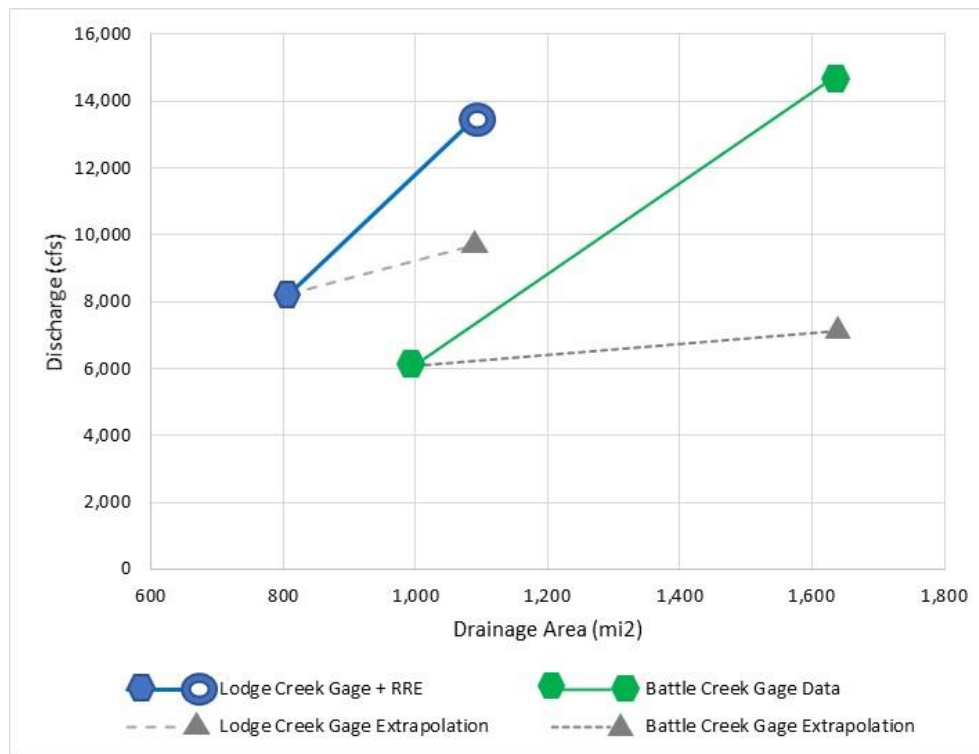
4.4. Major Reservoirs

Volume 1 of the Milk River Hydrologic Analyses included hydrologic analyses of closed basins, lakes ponds and reservoirs. However, within the Milk and Missouri River study area, two major reservoirs regulate flows on these rivers: Fresno Reservoir near Havre on the Milk River and Fort Peck Reservoir near Fort Peck on the Missouri River. Michael Baker previously prepared a guidance document for DNRC which summarizes FEMA guidance documents for performing floodplain studies on systems affected by these water bodies (Michael Baker, 2019). In accordance with FEMA guidance as summarized in the Baker guidance document, these reservoirs are located within riverine systems with sufficient gage data to perform hydrologic analyses that reflect the reservoir's effects on flows within the system. Also, these reservoirs are controlled systems with a record of consistent operation that supports use of the gage data to define the reservoir hydrology.

Each reservoir has a stream gage relatively close to the reservoir inlet and another gage downstream of the reservoir.   To evaluate the effects of reservoir operations and flow attenuation, the drainage area ratio transfer method was utilized on the stream gages that bound the reservoir. The downstream gage was utilized to extrapolate flows upstream of the gage up to the reservoir outlet based on the ratio of drainage areas. Similarly, the upstream gage was utilized to extrapolate flows downstream to the reservoir to account for increases in contributing drainage area below the gage that would flow into the reservoir. The results of flows are provided in **Appendix A**. On the Milk River, flow node MR-453.5 is immediately below Fresno Dam, and MR- 483.1 is the inlet to the reservoir. The corresponding 1% AEP flows associated with these locations are 8,997 cfs (Fresno

outlet) and 16,530 cfs (Fresno inlet). On the Missouri River, flow node MO-08 is immediately below Fort Peck Dam, and MO- 12 is the inlet to the reservoir. The corresponding 1% AEP flows associated with these locations are 54,800 cfs (Fort Peck outlet) and 127,888 cfs (Fort Peck inlet).

5. Summary/Discussion

5.1. Peak Flow Frequency Analysis

This peak flow frequency analysis was performed for stream gages on the mainstem Milk River and for select tributaries to the Milk River in Valley County, Phillips County, Blaine County, and Hill County, Montana. The peak flow frequency analyses were performed for the flows that correspond to the 10%, 4%, 2%, 1%, and 0.2% AEPs. In addition to these AEPs, the 1% plus discharge value was determined at each flow node, which incorporates a standard error of prediction into the 1% AEP calculations. These peak flows were calculated using the State of Montana regression equations. The standard error of prediction for the peak flow rates for the 1% annual-exceedance-probability event ranges from 54.5% in the Northeast Plains hydrologic region to 73.5% in the East-Central Plains hydrologic region.   The peak flows for approximately 113 flow nodes are provided in **Appendix A. Figures 2 through 15** indicate the flow change locations and recommended 1% AEP flow values for use in hydraulic modeling and subsequent floodplain mapping of the enhanced tributaries. **Figures 26 through 29** indicate the flow change locations and recommended 1% AEP flow values for use in hydraulic modeling and subsequent floodplain mapping of the mainstem Milk River. It is anticipated that hydraulic modeling for floodplain study purposes would conservatively apply flow values from a flow node to the immediate upstream reach until the next upstream flow node. For nearly all of the enhanced tributary watersheds, a flow was placed at the upstream extents of the enhanced reach. While this uppermost flow node is not expected to be applied directly to floodplain study hydraulic analyses (because it would tend to apply to the reach upstream of the node), it does provide an indication of the relative magnitude of flow in reaches above the study and is useful for comparison purposes. **Figures 30 through 41** provide a plot of Annual Exceedance Probability calculated flows versus drainage area at the flow node of interest for each tributary that will be studied using enhanced study methods.

Milk River watershed hydrologic analysis Volume 1 compared the flood-frequency peak flow analysis results for seventeen gage locations that corresponded roughly to node locations where peak flows were determined by regional regression analyses. At sixteen of these seventeen locations, discharges calculated by Bulletin 17C methods fell within the standard error of prediction for the regression equation. At one location (Gage 06155200, Alkali Creek near Malta), the regression results fall just outside of the standard error. Discussions with USGS personnel indicates that Alkali Creek is one of the most hydrologically complex sites in the Milk River study area. The 90% confidence interval for the 1% annual exceedance probability for the Alkali Creek gage is 4,130 − 196,000 cfs. Additionally, during very high flood events, Alkali Creek overflows into the Beaver Creek drainage (documented in 2016 and likely occurred in 1986). Additional investigations into improving peak flow estimates (MOVE3 and weighting with regional regression equations) either did not significantly improve results or were not appropriate because the site did not correlate well with any other gages and the site is

significantly affected by upstream dams (38% of the drainage area). Thus, these conditions provide the best explanation for the difference between flood-frequency peak flow gage analyses and results using regional regression equations and indicate close agreement between the gaged results and results using regional regression equations.

5.2. Issues Identified During Analysis

5.2.1. Milk River at Lohman, Montana gage (USGS 06143000)

Analyses of the mainstem Milk River gages identified anomalous results for the Milk River at Lohman, Montana gage (USGS 06143000). The Milk River at Lohman gage has 13 years of peak flow data available between 1939 and 1952. The calculated 1% AEP flow at this site is 8,950 cfs. Approximately 16 miles upstream of this site is another USGS gage (USGS 06140500 Milk River at Havre, Montana), which has 90 years of peak flow data between 1899 and 2018. However, 66 of these peak flows available after Fresno Dam was constructed (1939) were used in the flood frequency analyses as the regulated flow record (1952 to 2018). The calculated 1% AEP flow is 11,800 cfs. Approximately 50 miles downstream of the Lohman gage is another USGS gage (06154100 Milk River near Harlem, Montana) which has 48 years of peak flow data between 1952 and 2018. The calculated 1% AEP flow for this site is 18,300 cfs. While the higher peak flow estimates at the Harlem gage are consistent with the expected increase in peak flows as the watershed area increases, the drop in peak flow estimates between the Havre and Lohman gages is not consistent with the expected increase in peak flow estimates the further down in the watershed the stream gage is. Given that there is not extensive floodplain storage nor does the character of the river change between the Havre and Lohman gages, the most likely explanation for unexpected trends in peak flow between Havre and Lohman are attributed to the relatively short peak flow history for the Lohman gage (13 peak flow events, ending in 1952) compared to the much longer peak flow history available at the Havre gage (66 peak flow events, ending in 2018). In the presentation of peak flow frequency results (Table 1-7 of Siefken, 2021), the USGS indicates which gages and frequency analyses are most appropriate for floodplain mapping purposes. USGS determined that the Lohman gage peak flow results are not likely to be appropriate for floodplain mapping purposes. Thus, after careful consideration, it was determined that the Lohman gage peak-flow results would not be utilized in the flow recommendation for hydraulic analyses and floodplain mapping. Instead, flows between the Havre gage and the Harlem gage were determined by using the drainage area ratio methodology for estimating peak flow frequencies at an ungaged site on a gaged stream as described in **Section 4.2.3**. That is, below Havre, the drainage area ratio between the Havre gage drainage area and ungaged locations downstream of Havre is applied to estimate the peak flows down to the confluence with Battle Creek (near Chinook). Since Battle Creek is a significant tributary with a relatively large contributing drainage area, the drainage area ratio method was applied for ungaged sites upstream of the Harlem gage using the Harlem gage and drainage areas at ungaged sites up to the confluence of Battle Creek. This approach was utilized rather than applying the two-site logarithmic interpolation method (**Section 4.2.2**) between the Havre and Harlem gages. The reason is that above Battle Creek, the peak flow characteristics are best represented by the watershed influences above Battle Creek, and below Battle Creek, the peak flow characteristics are best represented by watershed influences

that include Battle Creek and reflected at the Harlem gage. One determining factor that justifies using the drainage area ratio approach even though there are two gages and logarithmic interpolation is possible is the peak-flow frequency results for Battle Creek. The 1% AEP for Battle Creek stream gage is 14,700 cfs. This is remarkably close to the 18,300 cfs 1% AEP for the Milk River at Harlem for a tributary that has a contributing drainage area that is about 16% of the contributing drainage area for Milk River at Harlem. Battle Creek clearly has significant influence on the hydrologic characteristics of the Milk River downstream of their confluence.

5.2.2. Milk River at Havre, Montana gage (USGS 06140500)

An additional item to note relates to the peak-flow frequency analysis performed by USGS at the Milk River at Havre site. A preliminary review of peak-flow analyses of the Havre gage indicated that Pearson Type III distribution did not fit the plotting positions very well. Michael Baker reviewed the peak flow data for the Havre gage site and performed a graphic analysis of the peak flow data. While the graphical analysis provided different results than the Bulletin 17C methods utilized by USGS and better fit the plotting positions, it was determined that the 1% and 0.2% AEP discharge values from the Bulletin 17C results reported by USGS for the 1% and 0.2% AEP's are more reasonable than the graphical analysis and are the recommended flow values for use in Milk River watershed floodplain studies.

As indicated previously, the USGS was scoped to perform peak-flow frequency analyses for stream gages on the mainstem Milk River and select tributaries to the Milk River. As the USGS initiated and reviewed analysis results, a number of issues were identified that affect the hydrologic data that is intended to be utilized for future enhanced hydraulic analyses on the Milk River and tributaries. These issues are described below.

5.2.3. Beaver Creek near Havre, Montana gage (USGS 06140000)

The data for this site included mostly data from an upstream site that was run by the NRCS, and those data were incorrectly adjusted. Those data were removed from NWIS, leaving only 3 years of record at 06140000. Therefore peak-flow frequency analysis is not possible for this site. Since Beaver Creek near Havre is a tributary that is slated for future hydraulic analyses using enhanced study methods, an analysis was performed using regional regression equations to provide peak-flow frequency results that will be used for future hydraulic modeling.

5.2.4. Milk River near Havre, Montana gage (USGS 06172000)

Peak-flow frequency results for the Vandalia gage are not presented. The Vandalia peak-flow data have been combined with nearby gage 06172310 Milk River at Tampico.

5.2.5. Milk River at Glasgow, Montana

The USGS does not operate a stream gage at Glasgow, but the National Weather Service operates an independent station on the Milk River at Glasgow using a wire-weight gage on the Highway 24 bridge at the Milk River. Information provided by the National Weather Service indicates that over time several factors related to recording Milk River stage changed, including: the different datums were referenced at various times, the reported data changed from reporting water surface elevation to

reporting water stage (depth) relative to streambed, the site was re-established on new bridge that replaced the previous bridge, and a nearby reference benchmark was updated to new a new datum level. Upon review of the National Weather Service station data, it was determined that it is not possible to perform peak-flow frequency analyses with the available information for this station.
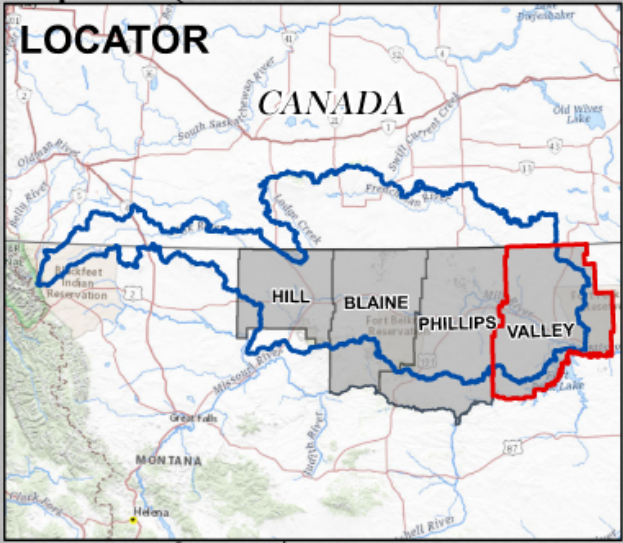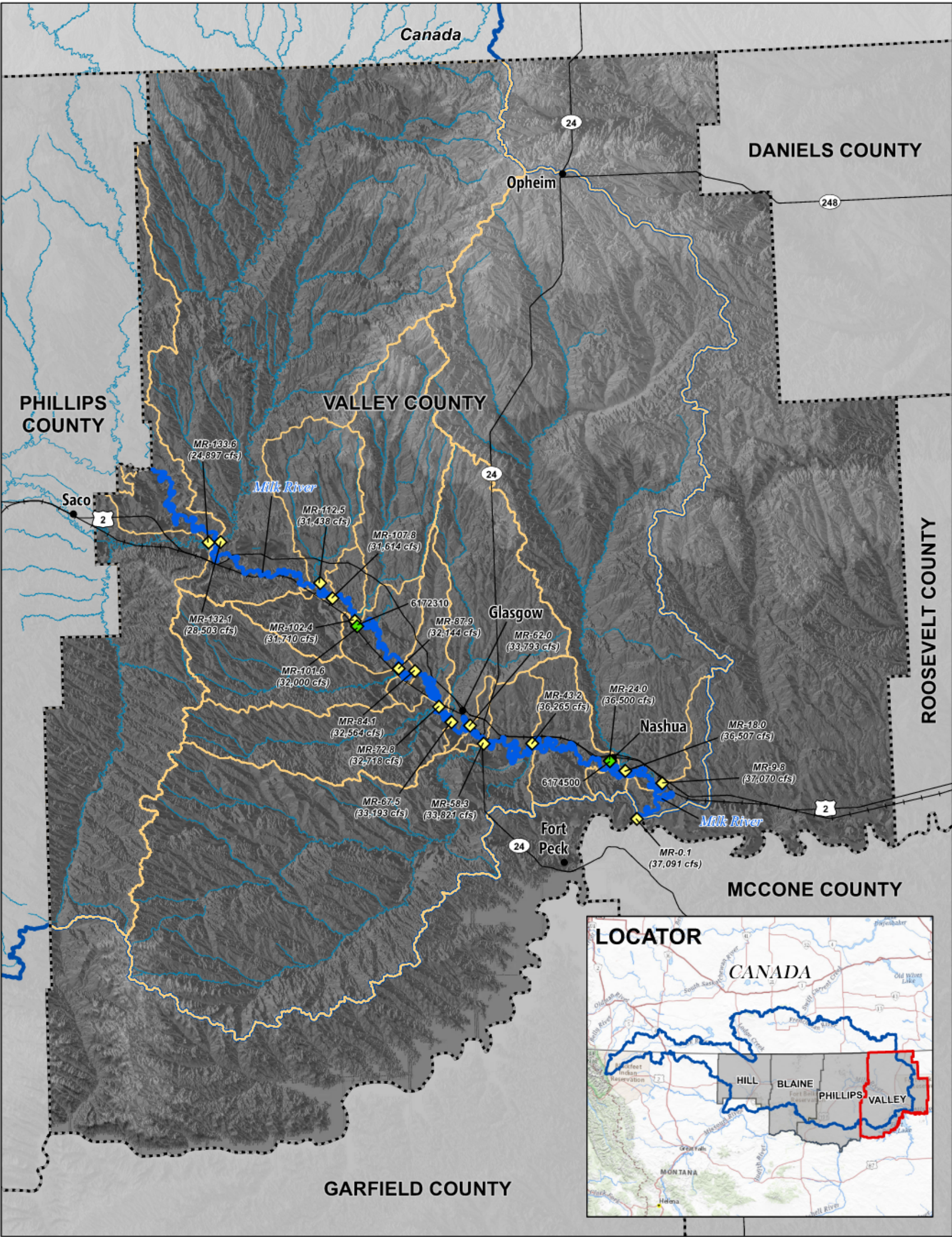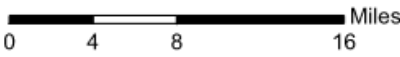
RECOMMENDED
1% AEP DISCHARGES
MILK RIVER
WATERSHED
(Valley County)

FIGURE 26

Map Date: 6/28/2021
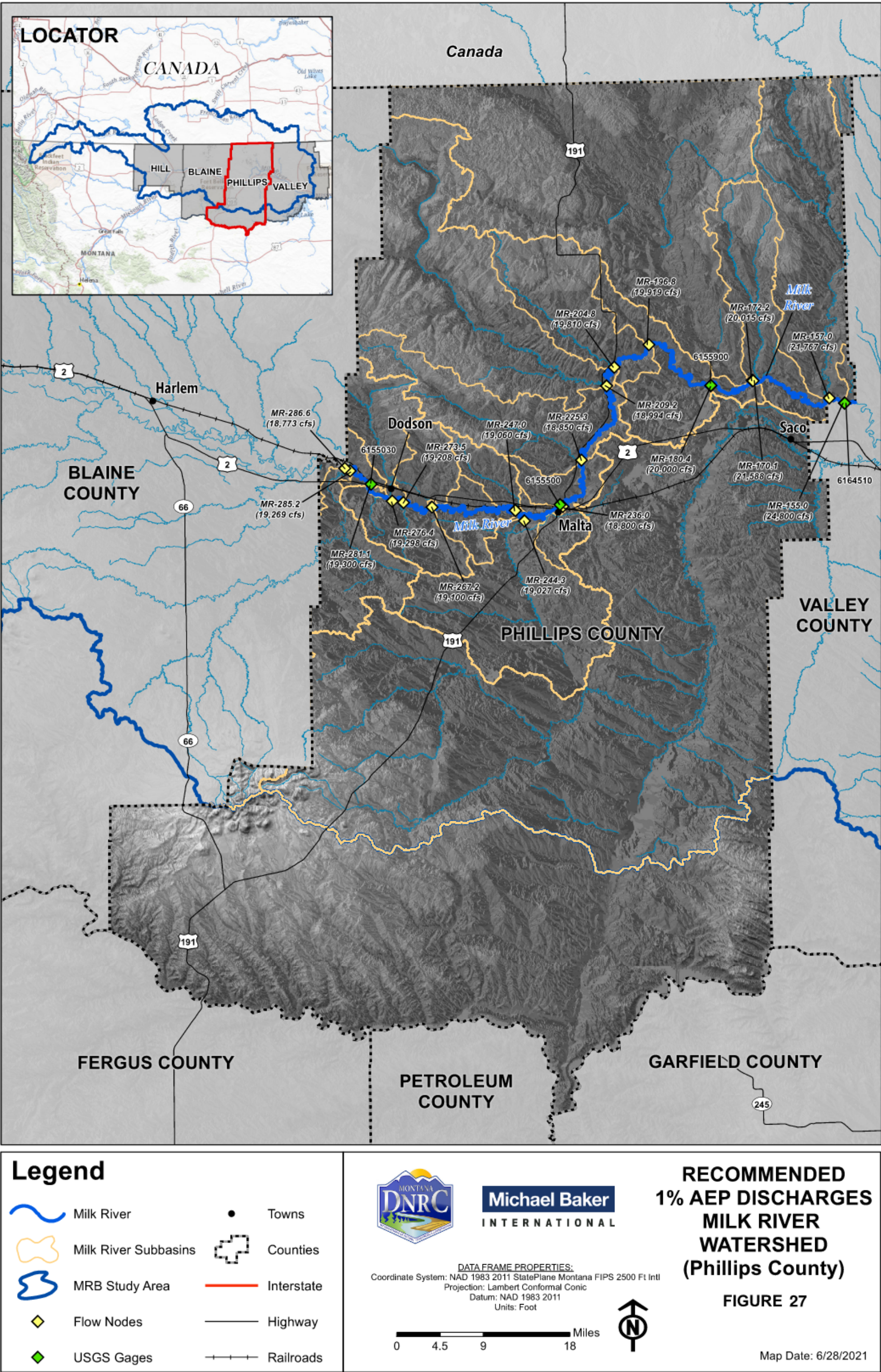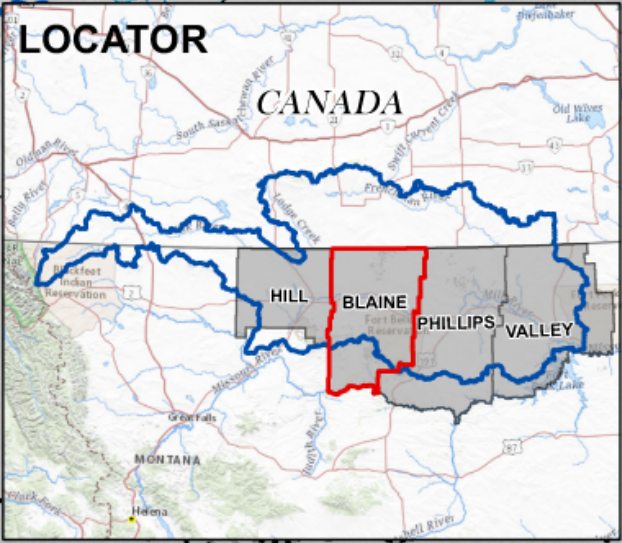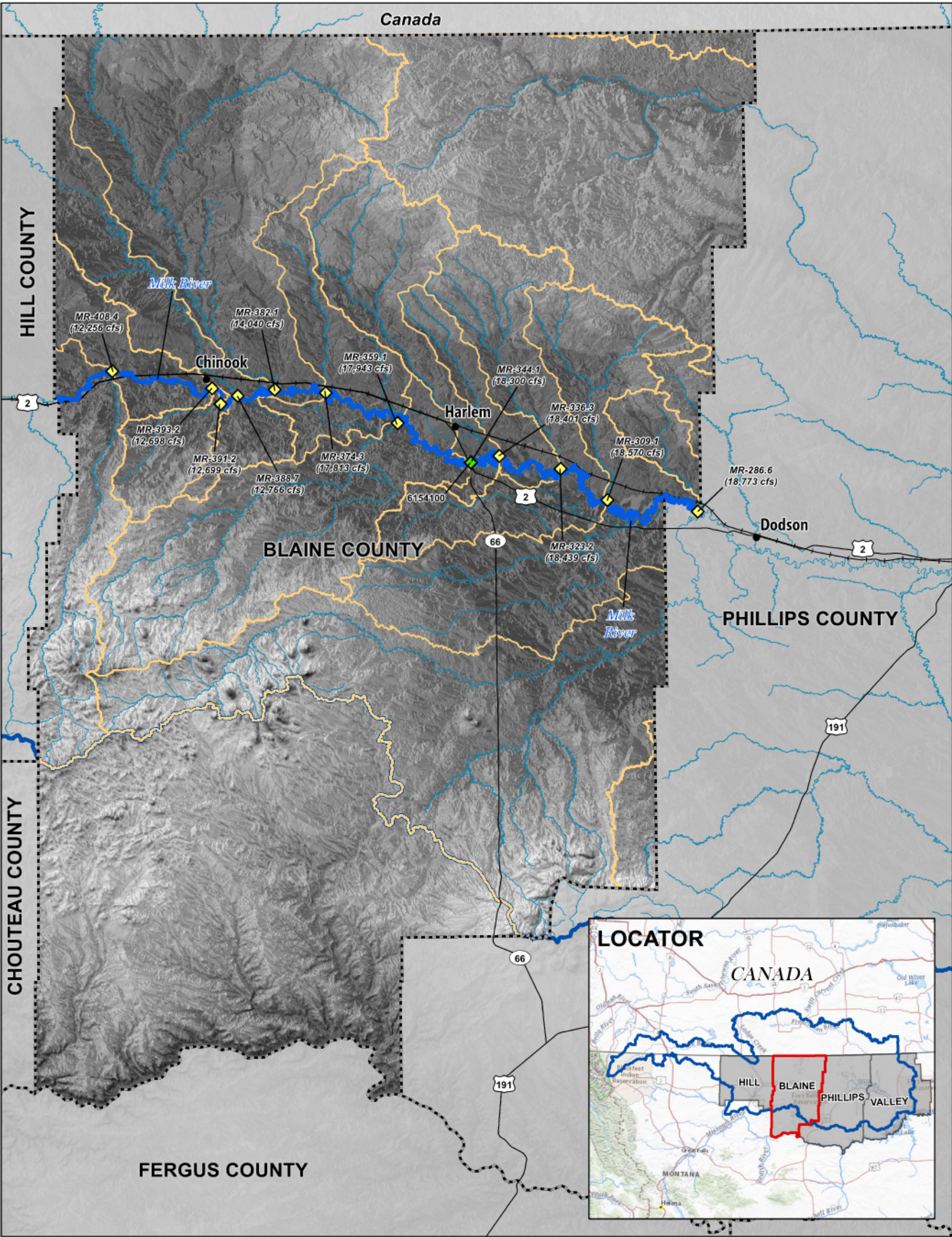
RECOMMENDED
1% AEP DISCHARGES
MILK RIVER
WATERSHED
(Phillips County)
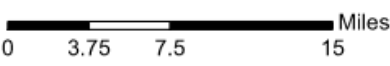
FIGURE 27

RECOMMENDED 1% AEP DISCHARGES MILK RIVER WATERSHED (Blaine County)

FIGURE 28
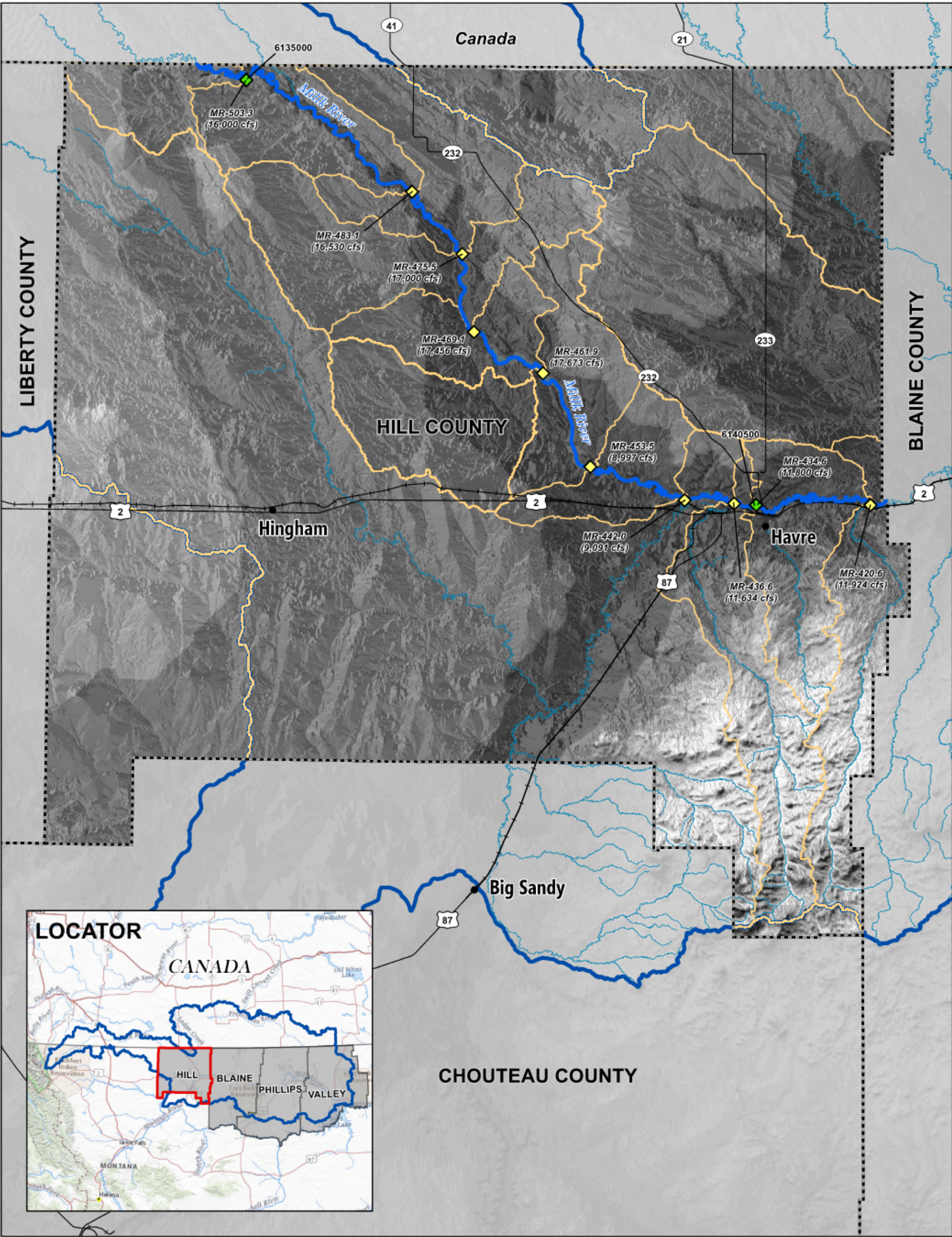
RECOMMENDED
1% AEP DISCHARGES
MILK RIVER
WATERSHED
(Hill County)

FIGURE 29

Figure 30. Calculated AEPs for Porcupine Creek.
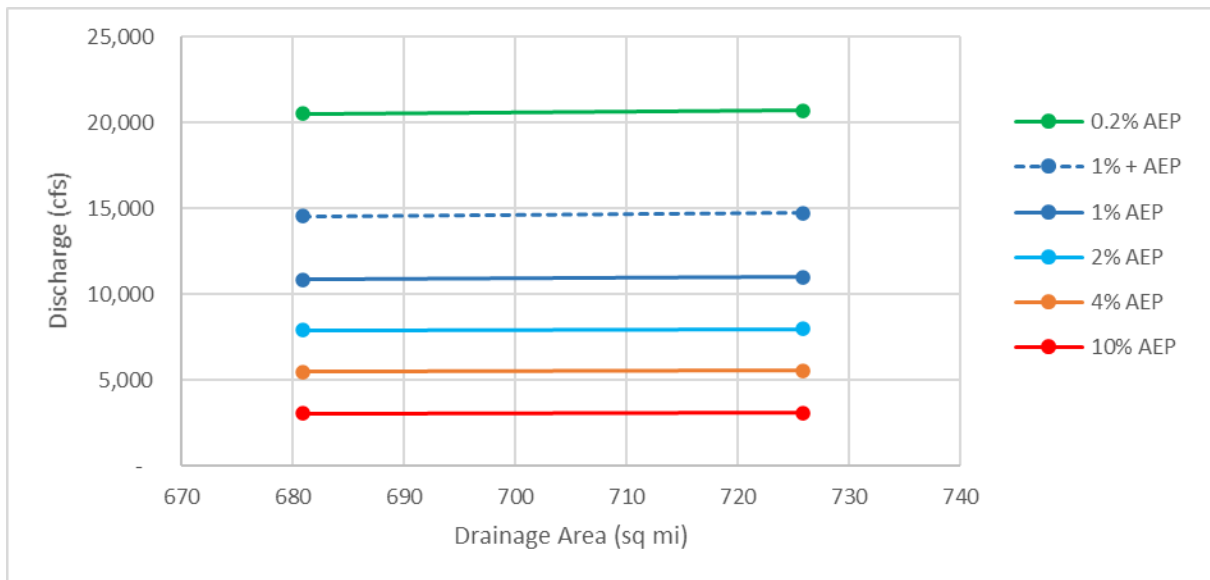
Figure 31. Calculated AEPs for Cherry Creek.
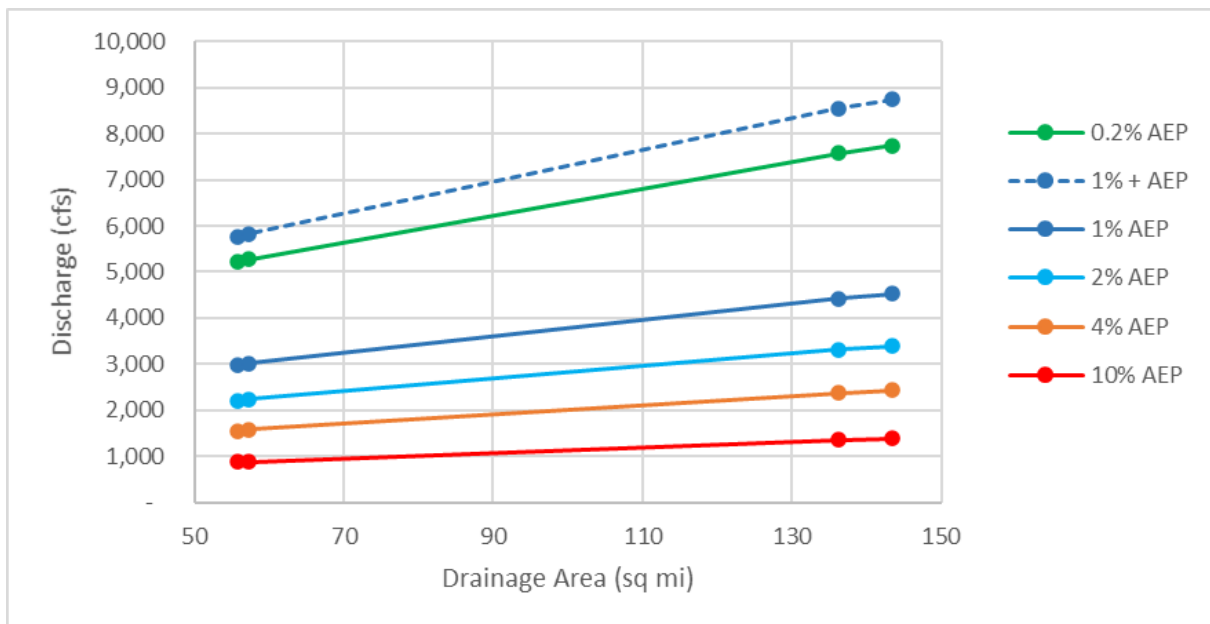
Figure 32. Calculated AEPs for East Fork Cherry Creek.
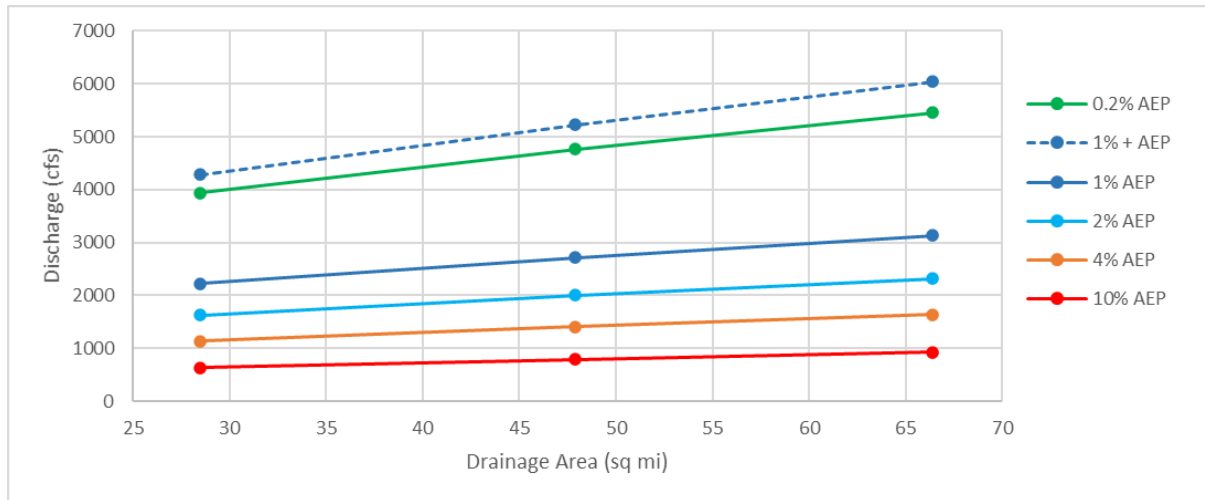
Figure 33. Calculated AEPs for Spring Coulee Creek.
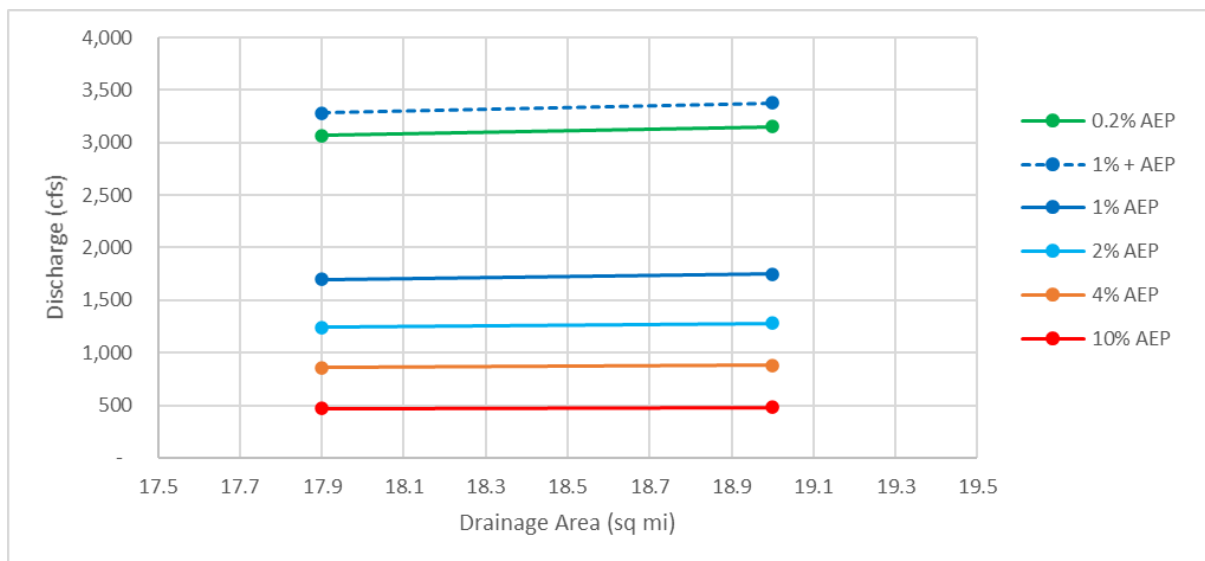
Figure 34. Calculated AEPs for Beaver Creek near Saco.
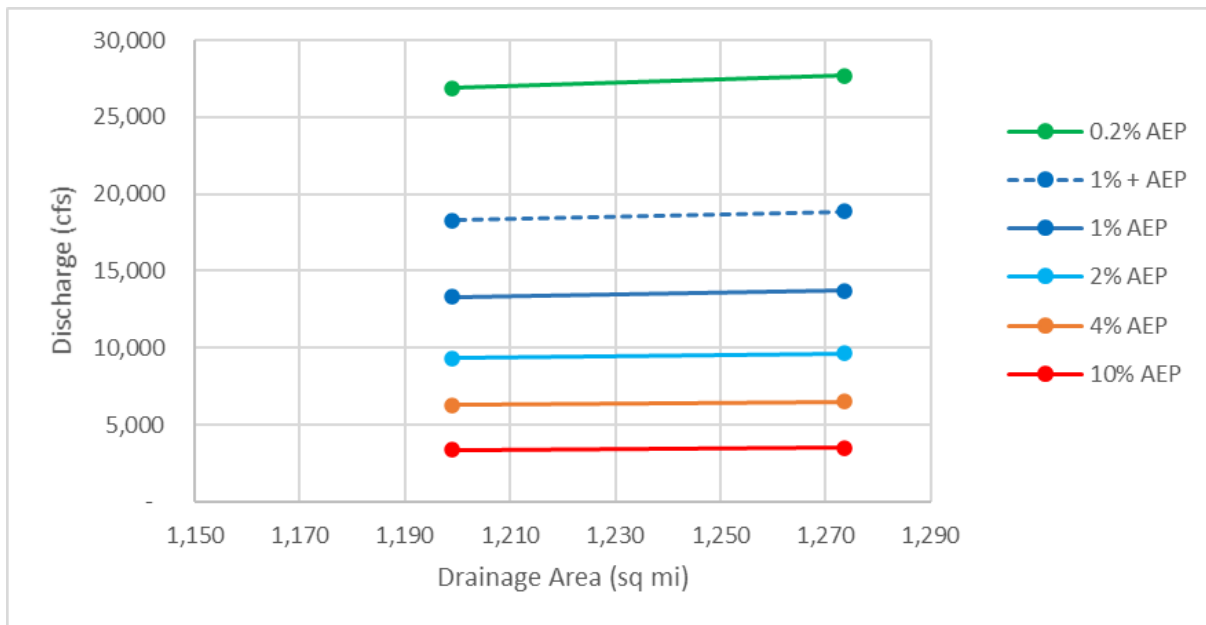
Figure 35. Calculated AEPs for Dodson Creek.
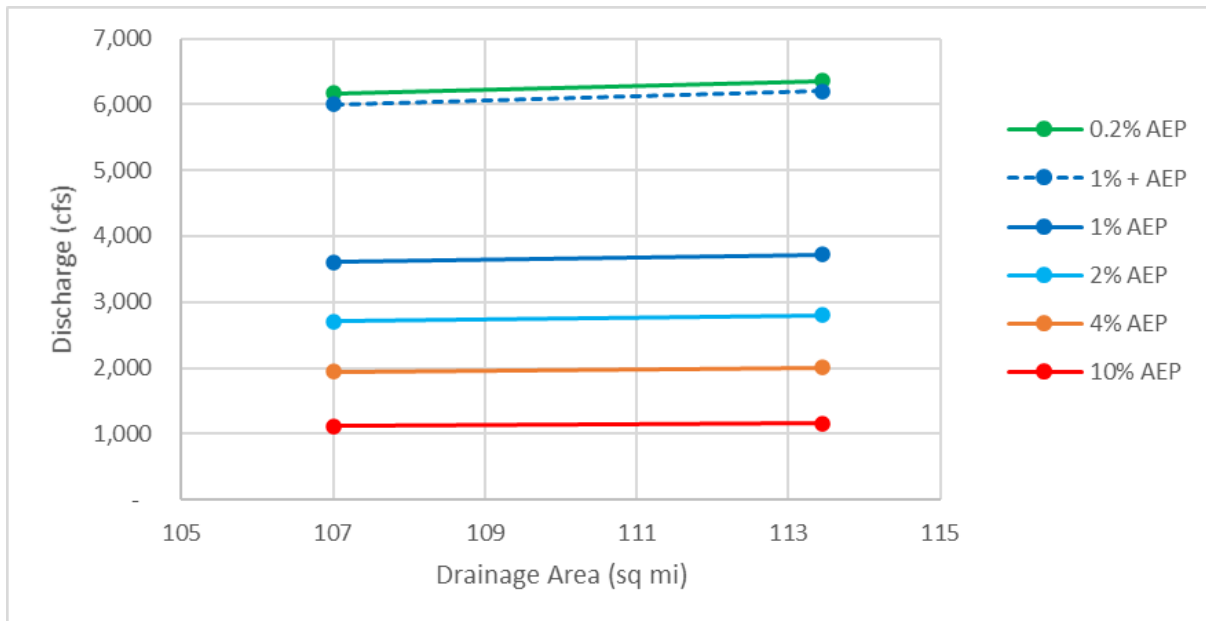
Figure 36. Calculated AEPs for Redrock Coulee.
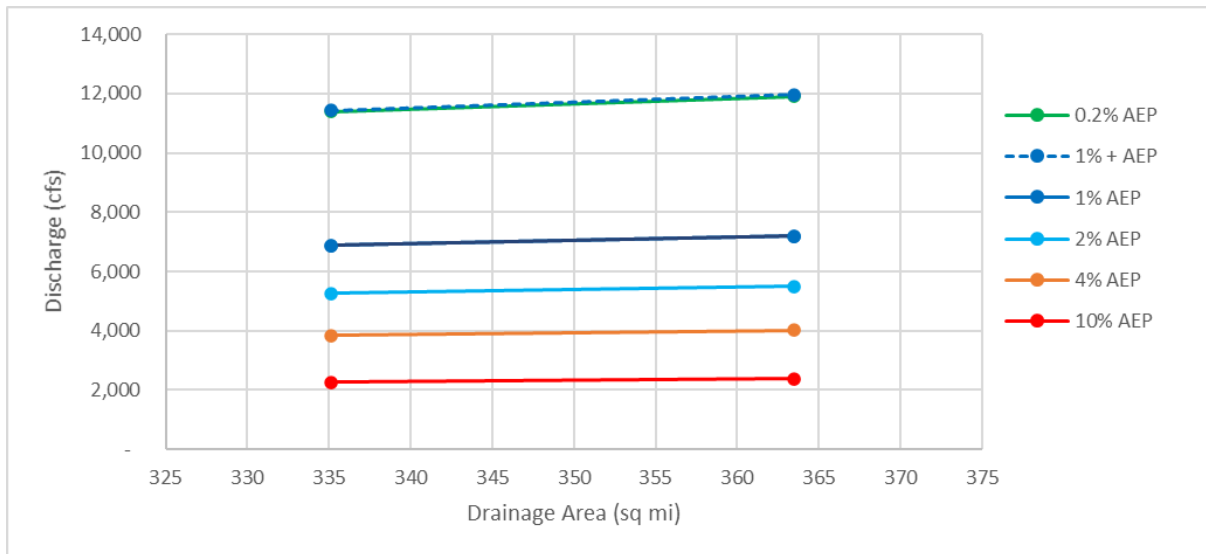
Figure 37. Calculated AEPs for Lodge Creek.
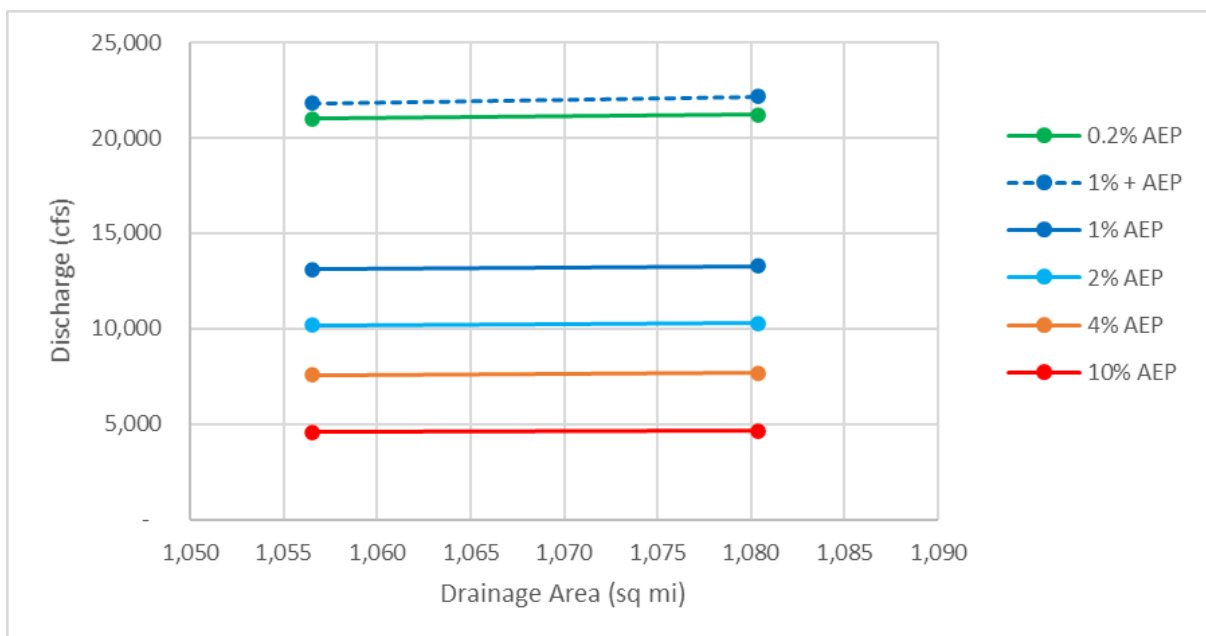
Figure 38. Calculated AEPs for Battle Creek.
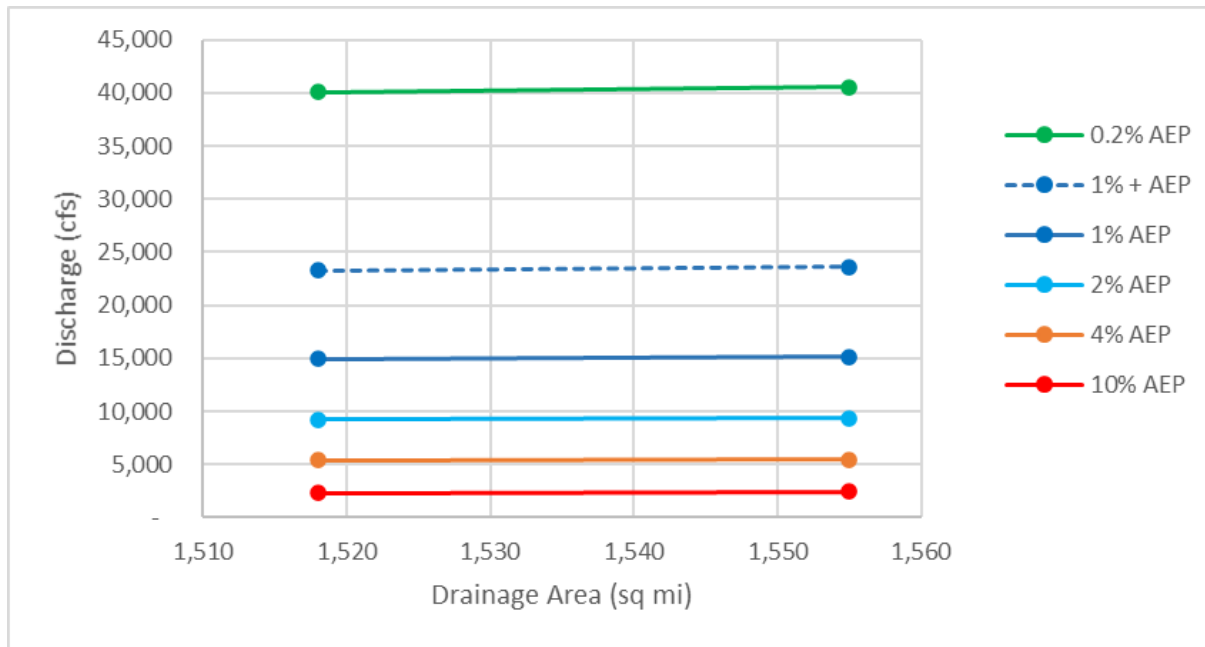
Figure 39. Calculated AEPs for Thirtymile Creek.
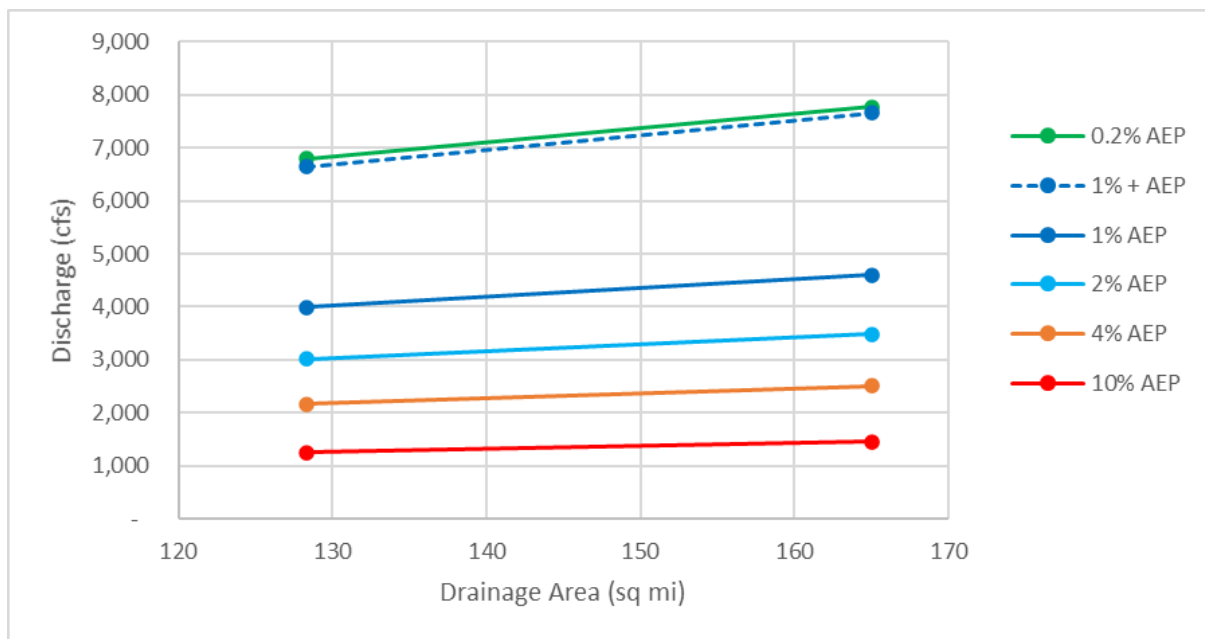
Figure 40. Calculated AEPs for Beaver Creek (near Havre).
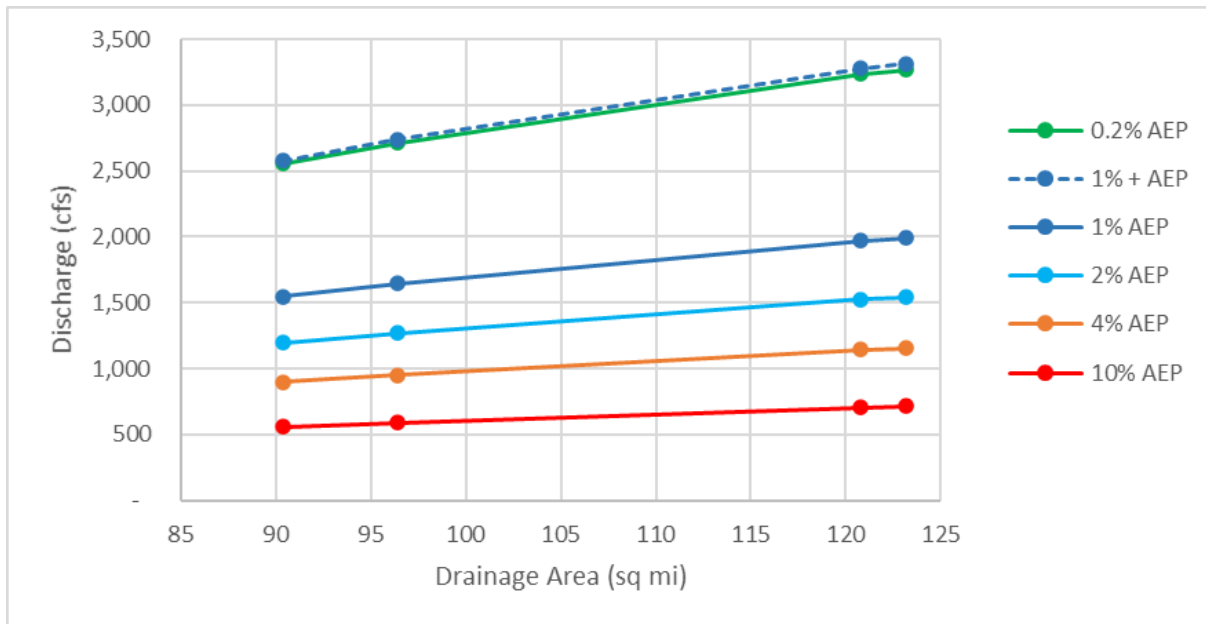
Figure 41. Calculated AEPs for Big Sandy Creek.
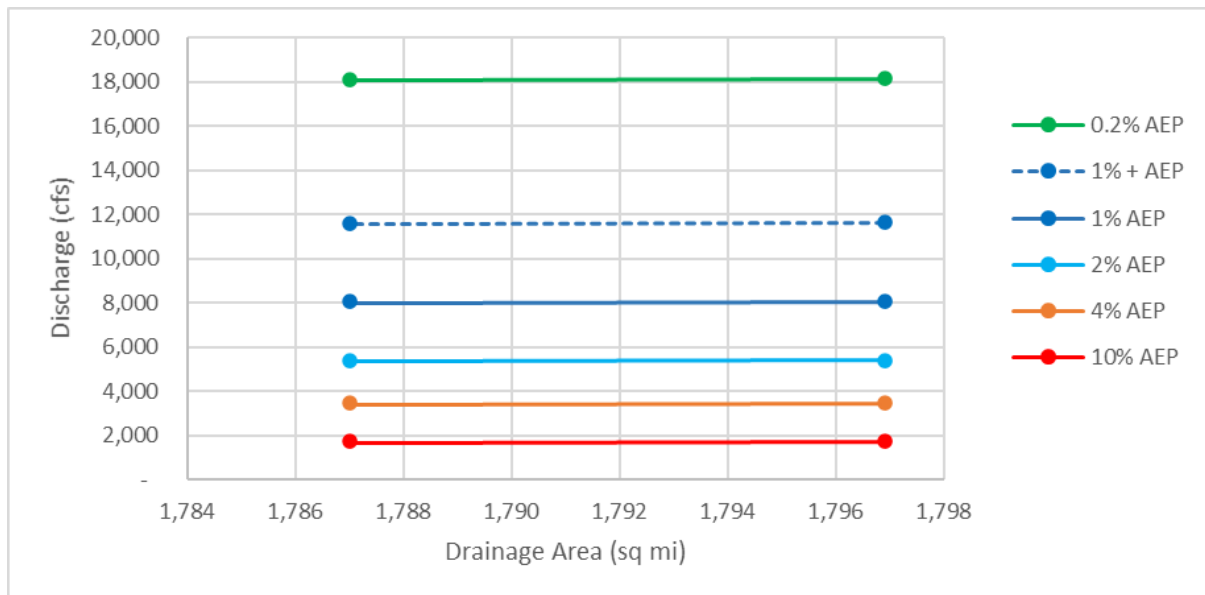
5.3. Study Comparison with Effective FIS

The peak flow gage analysis reported in this study include many gages within the Milk River watershed. These include four gage sites associated with flows published in the effective Flood Insurance Studies for Valley, Phillips, Blaine, and Hill Counties. **Table 7** provides a comparison between the effective FIS flows and those revised by this study. A discussion of the flow differences is included in the text following the table. Note that the locations provided in the table and discussion below are drawn from the effective FIS Summary of Discharge tables for Hill, Blaine, Phillips, and Valley County. Some general notes relevant to the comparisons:

- Where the FIS Summary of Discharge table reports the results at a USGS gage site, the revised peak flow frequency results from this study are compared against the FIS results and differences in results are noted and discussed below. Note that minor differences in contributing drainage area at gage locations are documented and reflect minor differences between the contributing drainage area published in USGS stream gage data and the drainage area calculation methods produced in this study using high resolution terrain data and detailed delineation methods.

- In general, differences in reported peak flow values at gage sites between the FIS and this study are a function of analyses of longer period of record (this study utilizes peak flow values through 2018). Differences can also be attributed to differences in peak flow frequency methods and how they are applied between Bulletin 17B (previous studies) and Bulletin 17C (this study). Differences between the two methods include application of record extension methods (e.g. MOVE3), implementing specific historic flood peaks as perception thresholds over discontinuous flow records, or weighting the at-site peak flow frequency analysis with regional regression equations.

- The four different county FIS's apply various methodologies to the hydrologic analyses that result in the flow values within each of the Summary of Discharges tables. Since all the four counties are affected by the Milk River as a principal flooding source, they all present the same fundamental representation (and discussion within the FIS) of the Milk River as the flooding source and all generally draw from a basin-wide analysis that utilizes peak flow frequency analyses results from USGS gauges at Havre and Nashua (and the Harlem gage in Blaine County). Additionally, each county's FIS references the influence of Fresno Reservoir on Milk River peak flows and discusses the 1952 flood event as the flood of record through the Milk River corridor that was an event that represented about the 1% AEP flood event through much of the corridor, although failure of Frenchman Dam is acknowledged as skewing the results below the confluence of the Milk River and Frenchman Creek.

- Other study methods reported in the effective FIS's generally utilize various representations of regional regression equations, either drawing from previous versions of USGS published regional regression equations, development of local single parameter regression equations to simplify

analyses, or producing Drainage Area – Discharge curves to establish flows at intermediate locations.

- This study primarily draws on updated peak flow frequency analyses for gages in the watershed with data through 2018; and for ungaged sites, utilizes the most recent USGS regional regression equations published as Montana StreamStats in 2016.

- Note that flow change locations (pour points) in this study were established based on criteria described in **Section 4.1.2**. In many instances, these flow change locations do not line up exactly with the locations identified in the various county FIS's. The primary reasons for this are described in criteria for establishing flow change locations and are also a result of the locations and extents of new enhanced studies within the Milk River watershed that in most cases do not directly correspond to studies documented in the effective FIS's. However, there is generally a flow change location established in this study that is relatively close to the location reported in the effective FIS Summary of Discharges table to allow a comparison between the results and discussion of differences. These sites are indicated by a Baker code that has an abbreviation for the flooding source followed by river station number (e.g. MR-453.5 represents the Milk River at River Station 453.5 (Below Fresno Reservoir)).

- The comparison discussions focus on changes to the 1% AEP flow values. In many cases only limited data are available in the effective FIS's regarding flows of other recurrence intervals. **Table 7** denotes the flow values that are not reported in the associated FIS with a "(1)" in the flow field to indicate the data were not reported. Additionally, **Table 7** does not include the 1%-plus flow value generated in this study, as no previous study produced a 1%-plus flow value. **Appendix A** provides a complete list of all flow values produced in this study for all AEP's, including the 1%-plus.

Table 7. Comparison of peak flow values from effective FIS's to results from this study.

Baker Node (or USGS Station ID if gaged site)	Location Description	Peak Flood Frequency Source	Drainage Area (mi²)	Peak Flow (cfs)					Methodology
				10% Annual Chance 10-year	4% Annual Chance 25-year	2% Annual Chance 50-year	1% Annual Chance 100-year	0.2% Annual Chance 500-year	
MR-453.5	Below Fresno Reservoir	USGS 2020 Peak Flow Analysis	3,067	3,114	4,912	6,710	8,997	16,736	At Site Peak Frequency Analysis for USGS Havre gage (06140500) using Bulletin 17C and drainage area transfer to below Fresno Dam. Period of record 1952 - 2018
		Blaine County Effective FIS (Effective 2006)	3,766	3,125	(1)	5,090	6,140	9,190	At Site Peak Frequency Analysis using Bulletin 17B from USBR furnished flow data below Fresno Dam. Period of record 1947 - 1983
6140500	Milk River at Havre	USGS 2020 Peak Flow Analysis	5,082	4,240	6,580	8,890	11,800	21,500	At Site Peak Frequency Analysis using Bulletin 17C. Period of record 1952 - 2018
		Hill County Effective FIS (Effective 1998)	5,844	(1)	(1)	(1)	20,900	(1)	At Site Peak Frequency Analysis using Bulletin 17B from USBR furnished flow data at Fresno Dam site and extended to Hwy 232 bridge at Havre. Period of record 1947 - 1983
		Blaine County Effective FIS (Effective 2006)	5,844	4,810	(1)	8,910	11,300	18,600	At Site Peak Frequency Analysis using Bulletin 17B. Period of record 1952 - 1981 (record extension back to 1939 using Bulletin 17B methodologies)
MR-393.2	Milk River at Chinook	USGS 2020 Peak Flow Analysis	5,826	4,609	7,122	9,593	12,698	23,007	Drainage area transfer of Havre gage
		Blaine County Effective FIS (Effective 2006)	6,455	5,330	(1)	9,820	12,400	20,100	Drainage area transfer of Havre gage. Also supported by Phillips County effective FIS through Drainage Area - Discharge curves/equations.
MR-374.3	Milk River at Zurich	USGS 2020 Peak Flow Analysis	8,634	6,100	9,810	13,419	17,813	32,383	Drainage area transfer of Harlem gage
		Blaine County Effective FIS (Effective 2006)	9,345	7,810	(1)	14,100	17,500	27,000	Drainage area transfer of Havre gage. Also supported by Phillips County effective FIS through Drainage Area - Discharge curves/equations.
6154100	Milk River at Harlem	USGS 2020 Peak Flow Analysis	9,079	6,290	10,100	13,800	18,300	33,200	At Site Peak Frequency Analysis using Bulletin 17C. 48 peaks in Period of record 1952 - 2018. 1978 peak (9,800 cfs) identified has historic peak and treated as perception threshold in years 1970 to 1982. Site identified as having Major flow regulation.
		Blaine County Effective FIS (Effective 2006)	9,822	6,510	(1)	17,400	25,300	57,500	At Site Peak Frequency Analysis using Bulletin 17B. 31 peaks in Period of record 1952 - 2002. Identified the 1952 and 1986 floods were highest in 50 years. Site identified as having Minor flow regulation.
MR-285.2	Milk River near Peoples Creek	USGS 2020 Peak Flow Analysis	10,615	6,987	11,262	15,060	19,269	31,063	interpolation between Harlem and Dodson
		Blaine County Effective FIS (Effective 2006)	10,492	(1)	(1)	(1)	26,300	(1)	gage transfer from Harlem
6155500	Milk River at Highway 2 in Malta	USGS 2020 Peak Flow Analysis	11,163	12,000	14,700	16,700	18,800	24,000	At Site Peak Frequency Analysis using Bulletin 17C. 26 peaks in Period of record 1903-2018
		Phillips County Effective FIS (Effective 1987)	11,762	9,900	(1)	17,650	21,600	32,300	Single parameter regression equations applied between Havre and the confluence with Missouri River based on Drainage Area-Discharge relationships between Havre and Nashua
6174500	Milk River at Nashua	USGS 2020 Peak Flow Analysis	20,771	18,300	25,200	30,700	36,500	50,700	At MOVE3 Peak Frequency Analysis using Bulletin 17C. Used 101 peaks in Period of record between 1915-2018. utilized data from Milk River at Tampico (22 peak flows synthesized from Trampico)
		Phillips County Effective FIS (Effective 1987)	22,332	19,200	(1)	33,000	39,100	53,700	At Site Peak Frequency Analysis using Bulletin 17B. Period of record 1939 - 1981
BCH-0.0	Beaver Creek near Hwy 2 (Havre)	Baker 2020 Regional Regression Equations	123	716	1,155	1,542	1,991	3,270	USGS Regional Regression Equations (2016)
		Hill County Effective FIS (Effective 1998)	121	(1)	(1)	(1)	3,070	(1)	USGS Regional Regression Equations (1986)
BSC-0.0	Big Sandy Creek near Hwy 2	Baker 2020 Regional Regression Equations	1,797	1,726	3,451	5,397	8,064	18,150	At Site Peak Frequency Analysis using Bulletin 17C. Drainage area transfer method. 58 peaks in Period of record 1946-2018
		Hill County Effective FIS (Effective 1998)	1,814	(1)	(1)	(1)	11,700	(1)	At Site Peak Frequency Analysis using Bulletin 17B. 22 years peak flow data available, record extended to 40 years
LC-0.1	Lodge Creek at mouth	Baker 2020 Regional Regression Equations	1,067	4,610	7,610	10,300	13,200	21,100	Baker applied USGS Regional Regression Equation (NE Plains). Deemed more reliable than applying gage transfer from gage at border (major regulated) to an unregulated area)
		Blaine County Effective FIS (Effective 2006)	1,094	3,820	(1)	7,530	9,410	17,500	Single parameter regression equations developed from nearby stream gage data to simplify USGS regression equations to just Drainage area, not the other USGS regression parameters
RC-0.6	Redrock Coulee at mouth	Baker 2020 Regional Regression Equations	363	2,380	4,020	5,500	7,190	11,900	Baker applied USGS Regional Regression Equation (NE Plains).
		Blaine County Effective FIS (Effective 2006)	265	1,760	(1)	3,820	4,950	10,000	Single parameter regression equations developed from nearby stream gage data
TC-4.4	Thirtymile Creek	Baker 2020 Regional Regression Equations	165	1,459	2,512	3,480	4,601	7,772	Baker applied USGS Regional Regression Equation (NE Plains).
		Blaine County Effective FIS (Effective 2006)	196	1,375	(1)	3,080	4,040	8,500	Single parameter regression equations developed from nearby stream gage data
PC-18.5	Porcupine Creek above East Fork	USGS 2020 Peak Flow Analysis	681	3,060	5,473	7,893	10,871	20,521	At Site Peak Frequency Analysis using Bulletin 17C, weighted by Regional Regression Equations. Drainage area transfer method. 58 peaks in Period of record 1946-2018
		Valley County City of Nashua Effective FIS (Effective 2007)	510	(1)	(1)	(1)	7,330	(1)	At Site Peak Frequency Analysis using Bulletin 17B. Drainage area transfer method. 33 peaks in Period of record 1909 - 1990 weighted by Regional Regression Equations
PC-0.1	Porcupine Creek above gage at Nashua	USGS 2020 Peak Flow Analysis	726	3,093	5,536	7,982	10,991	20,736	At Site Peak Frequency Analysis using Bulletin 17C, weighted by Regional Regression Equations. Drainage area transfer method. 58 peaks in Period of record 1946-2018
		Valley County City of Nashua Effective FIS (Effective 2007)	733	(1)	(1)	(1)	8,750	(1)	At Site Peak Frequency Analysis using Bulletin 17B. 33 peaks in Period of record 1909 - 1990 weighted by Regional Regression Equations

Notes: (1) data not provided

5.3.1. MR-453.5 Milk River below Fresno Reservoir

This study reports a nearly 2,900 cfs increase in the 1% AEP flow at a location just below Fresno Reservoir as compared to the Blaine County effective FIS (effective 2006). 1% AEP flows increase from 6,140 cfs (Blaine effective FIS) to 8,997 cfs (this study). This increase can be attributed to applying Bulletin 17C analyses methodologies for peak flow data at the Milk River Havre gage (USGS 6140500) in the upstream reach to the below Fresno Dam location on the Milk River. Evaluating the flow conditions below Fresno Dam based on USGS gage data at Havre allows consideration of 35 more years of peak flow data since the previous analysis (effective FIS) was performed. The effective FIS utilized an analysis period of a 1947 to 1983 peak flow record, while this updated (2021 study) utilizes peak flow data through 2018. Both analyses consider the 1952 flood event as the historic flood and represent significant attenuation of peak flows that enter the reservoir (1% AEP inflows to Fresno Dam are on the order of 20,000 cfs).

5.3.2. USGS 6140500 Milk River at Havre, MT

This study updates the peak flow flood frequency analyses reported in the Hill County effective FIS (effective 1998) and Blaine County effective FIS based on data through 2018. This study reduces the 1% AEP flow value from the Hill County effective FIS flow by 9,000 cfs, and is essentially the same as the Blaine County effective FIS flow (11,800 cfs vs. 11,300 cfs). The Hill County effective FIS utilizes a Bulletin 17B peak flow analysis of USBR flow data at Fresno Reservoir and applies it to the Highway 232 bridge at Havre. The Blaine County effective FIS utilizes the results of a Bulletin 17B peak flow frequency analysis on the Milk River at Havre gage data for a period of record from 1952 to 1981 (and reports that the approach implements record extensions methodologies to incorporate a synthetic record that goes back to 1939). The relatively close values between the Blaine County effective FIS methodology and 2020 USGS study indicates stability in the analyses describing peak flow characteristics at the Milk River at Havre, MT stream gage.

5.3.3. MR-393.2 Milk River at Chinook, MT

The Blaine County effective FIS publishes peak flow frequency analyses for the Milk River at Chinook, MT (upstream of Redrock Coulee). The Blaine County effective FIS applies a drainage area transfer methodology to the results of the Havre gage peak flow frequency analyses. Similarly, this study applies a drainage area transfer methodology to the results of the Havre gage peak flow frequency analyses. The results of both analyses are within 300 cfs (12,400 cfs (Blaine County FIS) vs. 12,698 cfs (this study)). These results are consistent with relatively close agreement of the two studies analyses of the Havre gage.

5.3.4. MR-374.3 Milk River at Zurich, MT

This study results in a minor increase in 1% AEP flow on the Milk River at Zurich, an increase of about 300 cfs over the Blaine County effective FIS (17,500 cfs (Blaine County FIS) vs. 17,813 cfs (this study)). The difference appears to be attributed to the increase in period of record of peak flows for the analysis and minor differences between Bulletin 17B and Bulletin 17C methodologies. The increase is relatively minor and is similar to the increase at the nearby Milk River at Chinook site. It is interesting that the

differences are similar between the Chinook and Zurich sites in that the Zurich analysis for this study applies drainage area transfer of the Harlem gage, while the Blaine County effective FIS indicates that the Havre gage was used as the basis for drainage area gage transfer. Additionally, the Phillips County effective FIS (effective 1987) presents Drainage Area – Discharge curves (and a supporting equation based on Drainage Area) which demonstrates close agreement with the Blaine County effective FIS results.

5.3.5. USGS 6154100 Milk River at Harlem, MT

There is a significant reduction in 1% AEP flows generated from this study (18,300 cfs) as compared to the 1% AEP flow reported in the Blaine County effective FIS (25,300 cfs). The difference is about 7,000 cfs and appears to be largely attributed to the increased flow records for this study (48 peaks vs. 31 peaks) and differences in how peak flow frequency analyses were applied under Bulletin 17C (this study) and Bulletin 17B (Blaine County effective FIS). This study utilized two peak flow events as historic peaks (1952 peak of 19,000 cfs and the 1978 peak of 9,800 cfs). These were used to establish perception thresholds for the period of record before 1952 (1939 to 1951) and the period of 1970 to 1982 when there are no peak flow data (except the 1978 peak). The Blaine County effective FIS indicates they utilized the 1952 event and a 1986 event in their historic peak analyses and may not have considered the 1970 to 1982 missing peaks in the analysis. Lastly, the peak flow analyses performed on the Harlem gage for this study identifies the site as having Major Regulation, whereas the Blaine County effective FIS treats the location as only having Minor Regulation. The Harlem USGS gage is relatively close to Zurich (approximately 15 miles), and the reduction in 1% AEP flows in this study appears to be more consistent with 1% AEP flows through this portion of the Milk River.

5.3.6. MR-285.2 Milk River near Peoples Creek, MT

The 1% AEP flows from this study have been significantly reduced relative to the Blaine County effective FIS, about a 7,000 cfs reduction. This study results in a 1% AEP flow of about 19,300 cfs while the Blaine County effective FIS 1% AEP flow is 26,300 cfs. The 1% AEP flow reduction is consistent with the reduction in 1% AEP flow at the next upstream site, USGS gage for Milk River at Harlem. The Blaine County effective FIS notes that the Milk River near Peoples Creek was determined by using a Drainage Area ratio gage transfer method from the Harlem gage site, thus those two flows values are directly coupled. However, this study uses an interpolation method between two gages (using the logarithms of Drainage Area and Discharge) to determine the 1% AEP for this location. This site is between the Harlem USGS gage and a USGS gage at Dodson (USGS 06155030). The results indicate that analyses using the full body of available information appear to provide consistent results. Note that the Dodson site is not included in any of the Summary of Discharge tables for any of the four county effective FIS's. This is likely because the gage record was relative short compared to other available data when the effective flood studies were performed (period of record 1983 – 2018 for at site analyses).

5.3.7. USGS 6155500 Milk River at Highway 2 in Malta, MT

The 1% AEP for this site dropped 2,800 cfs from the 1% AEP value reported in the Phillips County effective FIS. The drop in discharge appears to be a result of a long period of record available for the site and due to different methodologies applied to the site. This study presents the results of an at site peak

flow frequency analysis following Bulletin 17C on 26 peaks in the period of record from 1908 to 2018. The 1% AEP flood determined by this study is 18,800 cfs. The 1% AEP flow published in the Phillips County effective FIS is 21,600 and was determined from a single parameter regression equation developed to provide peak flow estimates for the Milk River based on Drainage Area – Discharge relationships. These relationships provide results similar to the previously reported results in the Blaine County effective FIS for ungaged sites at Chinook and Zurich. It appears that several methodologies were utilized for determining peak flow frequency analyses and they are all tied to Bulletin 17B peak flow analyses at the Havre and Nashua gages.

5.3.8. USGS 6174500 Milk River at Nashua, MT

The results of this analyses indicate a 2,600 cfs reduction in the 1% AEP flow at the USGS gage at Nashua. This study utilizes a MOVE3 Peak Frequency Analysis using Bulletin 17C and determined the 1% AEP flow is 36,500 cfs. The record extension method extended the number of peak flows used in the analyses from 79 peaks (period of record 1940 - 2018) to 101 peaks by bringing in an additional 22 peaks by synthesizing peak flow data from the Milk River at Tampico gage (06172310) with peak flow data going back to 1915. The Phillips County effective FIS reports that the effective 1% AEP for the Nashua gage (39,100) was determined by following Bulletin 17B on peak flows occurring over a period of record from 1939 to 1981. Although significant in magnitude, the peak flow reduction is about a 7% reduction from the Phillips County effective FIS 1% AEP for the gage. It appears that the long record of peak flow data and utilizing MOVE3 methodology accounts for the reduction in 1% AEP flow at the Nashua gage.

5.3.9. BCH-0.0 Beaver Creek near Hwy 2 (Havre)

The Hill County effective FIS lists the 1% AEP flow for Beaver Creek near Highway 2 near Havre as 3,070 cfs. This study revises the 1% AEP flow to 1,991 cfs, or about a 1,080 cfs reduction in flow. Both analyses utilized Regional Regression Equation methodologies; this study from the USGS 2016 StreamStats publication and the Hill County effect FIS value from a 1986 USGS publication. Up to thirty additional years of flow data are now available for gages that went into developing the regression equations, and recent updates to the regression equations included additional evaluation of the suitability of gages that should be used to develop regional regression equations and the parameters that should be utilized within the equations to make peak flow estimates. The additional flow data and revision to gages/parameters appear to explain the significant reduction in 1% AEP flow.

5.3.10. BSC-0.0 Big Sandy Creek near Hwy 2

The Hill County effective FIS lists the 1% AEP flow for Beaver Creek near Highway 2 as 11,700 cfs. This study revises the 1% AEP flow to 8,064 cfs, or about a 3,600 cfs reduction in flow. The Hill County effective FIS reports that the effective 1% AEP flow was determined by using at site peak frequency analysis using Bulletin 17B on a flow record that contains 22 years of peak flow data. Record extension methods under Bulletin 17B resulted in an extended peak flow record of 40 peaks. The current study performed at site peak frequency analyses using a flow record with 58 peaks following Bulletin 17C. Historic events in the flow record were utilized to apply perception threshold periods based on events in 1969 and 1978. The Bulletin 17C methods and additional peak flow data used in the analyses appear to explain the reduction in 1% AEP values.

5.3.11. LC-0.1 Lodge Creek at Mouth

This study reports a nearly 3,800 cfs increase in 1% AEP flows for Lodge Creek at the confluence with the Milk River. The 1% AEP flow increase from 9,410 cfs as reported in the Blain County effective FIS to 13,200 cfs. The Blaine County effective FIS notes that single parameter (Drainage Area) regression equations were developed from nearby stream gage data to simplify the approach for estimating the 1% AEP flow. This was done to eliminate the need to determine the other parameters utilized in the USGS regional regression equations published at the time, and generate peak flow results simply as a function of Drainage Area. Note that Lodge Creek does contain a USGS stream gage at the northernmost extent of US at the border with Canada (Lodge Creek below McRae Creek, at International boundary USGS 06145500). An investigation was made into the appropriateness of utilizing this gage and applying gage transfer methods to determine peak flow values downstream at the mouth of Lodge Creek. The investigation revealed that the conditions under which the peak flow frequency analyses for the gage were not appropriate to assume as conditions further downstream at the mouth of Lodge Creek. Details of the assessment are presented in **Section 4.2.3**. Thus, it was determined that regional regression equations provide the best representation of peak flow values for Lodge Creek at the confluence with the Milk River. Additionally, the most recent regional regression equations published by USGS contain a more rigorous investigation into the gages and parameters that best describe flow conditions at ungaged sites and are superior to approaches that simplify more robust multi-parameter regression equations to locally-derived single parameter regression equations developed to simplify the calculations of peak flow values.

5.3.12. RC-0.6 Redrock Coulee at Mouth

This study reports about a 2,200 cfs increase in 1% AEP flows for Redrock Coulee near the confluence with the Milk River. The 1% AEP flow increase from 4,950 cfs as reported in the Blaine County effective FIS to 7,190 cfs. The Blaine County effective FIS notes that single parameter (Drainage Area) regression equations were developed from nearby stream gage data to simplify the approach for estimating the 1% AEP flow. This was done to eliminate the need to determine the other parameters utilized in the USGS regional regression equations published at the time, and generate peak flow results simply as a function of Drainage Area. The increased 1% AEP flow values developed in this study are justified because the most recent regional regression equations published by USGS contain a more rigorous investigation into the gages and parameters that best describe flow conditions at ungaged sites and are superior to approaches that simplify more robust multi-parameter regression equations to locally-derived single parameter regression equations developed to simplify the calculations of peak flow values.

5.3.13. TC-4.4 Thirtymile Creek

This study reports about a 560 cfs increase in 1% AEP flows for Thirtymile Creek in the study area. The 1% AEP flow increase from 4,040 cfs as reported in the Blain County effective FIS to 4,601 cfs. The Blaine County effective FIS notes that single parameter (Drainage Area) regression equations were developed from nearby stream gage data to simplify the approach for estimating the 1% AEP flow. This was done to eliminate the need to determine the other parameters utilized in the USGS regional regression equations published at the time, and generate peak flow results simply as a function of Drainage Area. The increased 1% AEP flow values developed in this study are justified because the most recent regional

regression equations published by USGS contain a more rigorous investigation into the gages and parameters that best describe flow conditions at ungaged sites and are superior to approaches that simplify more robust multi-parameter regression equations to locally-derived single parameter regression equations developed to simplify the calculations of peak flow values.

5.3.14. PC-0.1 Porcupine Creek above gage at Nashua, MT

Updated peak flow frequency analyses completed in this study result in an increase in 1% AEP flows for Porcupine Creek above the gage of about 2,240 cfs. The current 1% AEP flow for this gage as reported in the Valley County effective FIS (effective 2007) is 8,750 cfs and this study increases the 1% AEP flow to 10,991 cfs. The peak flows presented in Valley County effective FIS were developed following Bulletin 17B methods on a period of record from 1909 to 1990, weighted by previously developed regional regression equations. This study utilized Bulletin 17C methods on 58 peaks in a period of record from 1946 to 2018 and applies recently updated regional regression equations published by USGS in 2016. The increase in 1% AEP flow is justified through an increased period of record and peak flow values used in the analysis, updated methodologies in Bulletin 17C, and new regional regression equations that were recently developed after a more rigorous investigation into the gages and parameters that best describe flow conditions at ungaged sites.

5.4. FEMA Guidance and Standards

All flow values were determined using methods that meet FEMA guidance and standards. The results of this study will be used to produce revised flood hazard mapping in Valley County, Phillips County, Blaine County, and Hill County.

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Appendix A.

HYDROLOGY NODE DISCHARGE TABLE										
Stream	**Latitude**	**Longitude**	**Node ID**	**Drainage Area (mi²)**	Peak Discharge (cfs) for Annual Exceedance Probability Flows					
					10%	**4%**	**2%**	**1%**	**1% plus**	**0.20%**
Valley										
Porcupine Creek (GE)[1]	48.2574	-106.4025	PC-18.5	680.9	3,060	5,473	7,893	10,871	12,977	20,521
	48.1182	-106.3372	PC-0.1	725.9	3,093	5,536	7,982	10,991	13,121	20,736
Cherry Creek (RRE)	48.2916	-106.6083	CC-14.1	55.7	876	1,560	2,210	2,980	5,749	5,210
	48.2608	-106.6117	CC-9.6	57.3	889	1,580	2,240	3,020	5,826	5,270
	48.2422	-106.6365	CC-6.9	136.3	1,360	2,370	3,320	4,430	8,547	7,580
	48.1863	-106.6542	CC-0.1	143.5	1,390	2,430	3,400	4,530	8,740	7,740
East Fork Cherry Creek (RRE)	48.2529	-106.5484	EFC-4.7	28.5	632	1,140	1,630	2,220	4,283	3,940
	48.2543	-106.5603	EFC-3.9	47.9	786	1,410	2,000	2,710	5,228	4,760
	48.2607	-106.6089	EFC-0.1	66.4	922	1,640	2,320	3,130	6,039	5,460
Spring Coulee Creek (RRE)	48.2772	-106.5545	SC-2.8	17.9	469	860	1,240	1,700	3,280	3,070
	48.2534	-106.5584	SC-0.0	19.0	483	884	1,280	1,750	3,376	3,150
Milk River: Tampico to Juneberg (GI)	**48.5090[2]**	**-107.2170**	**MR-155.0**	**16,137**	**12,600**	**17,600**	**21,300**	**24,800**	**32,200**	**32,300**
	48.4171	-107.0921	MR-133.6	16,186	12,646	17,662	21,378	24,897	32,296	32,454
	48.4173	-107.0698	MR-132.1	17,974	14,355	19,930	24,244	28,503	35,801	38,238
	48.3630	-106.8875	MR-112.5	19,392	15,737	21,753	26,559	31,438	38,576	43,065
	48.3435	-106.8658	MR-107.8	19,476	15,819	21,862	26,697	31,614	38,740	43,357
	48.3146	-106.8254	MR-102.4	19,522	15,864	21,921	26,773	31,710	38,830	43,517
Milk River: Nashua to Tampico (GI)	**48.3080**	**-106.8216**	**MR-101.6**	**19,660**	**16,000**	**22,100**	**27,000**	**32,000**	**39,100**	**44,000**
	48.2538	-106.7477	MR-87.9	19,697	16,074	22,199	27,119	32,144	39,264	44,214
	48.2501	-106.7177	MR-84.1	19,804	16,288	22,488	27,464	32,564	39,742	44,836

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[1] Method of analysis: RRE = Regional Regression Equation, GI = Gage Interpolation, GE = Gage Extraction

[2] Bold text indicates values reported at gaging stations

Milk River Watershed Hydrologic Analysis: Volume 2

HYDROLOGY NODE DISCHARGE TABLE

Stream	Latitude	Longitude	Node ID	Drainage Area (mi²)	Peak Discharge (cfs) for Annual Exceedance Probability Flows					
					10%	4%	2%	1%	1% plus	0.20%
	48.2049	-106.6758	MR-72.8	19,843	16,366	22,594	27,591	32,718	39,916	45,064
	48.1856	-106.6537	MR-67.5	19,963	16,609	22,922	27,982	33,193	40,457	45,770
	48.1803	-106.6193	MR-62.0	20,113	16,916	23,335	28,476	33,793	41,138	46,662
	48.1573	-106.5958	MR-58.3	20,120	16,930	23,355	28,499	33,821	41,170	46,704
	48.1555	-106.5061	MR-43.2	20,715	18,180	25,038	30,507	36,265	43,935	50,348
Milk River: DS of Nashua *(GE)*	**48.1300**	**-106.3640**	**MR-24.0**	**20,771**	**18,300**	**25,200**	**30,700**	**36,500**	**44,200**	**50,700**
	48.1171	-106.3366	MR-18.0	20,780	18,304	25,205	30,706	36,507	44,208	50,709
	48.0998	-106.2693	MR-9.8	21,563	18,610	25,613	31,190	37,070	44,890	51,451
	48.0571	-106.3186	MR-0.1	21,593	18,622	25,628	31,208	37,091	44,916	51,479
Phillips										
Beaver Creek near Saco *(GE)*	48.4358	-107.3272	BCP-30.9	1,274	3,486	6,493	9,649	13,738	22,876	27,718
Dodson Creek *(RRE)*	48.4134	-108.2549	DC-4.2	107	1,117	1,942	2,708	3,602	5,998	6,164
	48.3781	-108.2457	DC-0.1	113.4	1,158	2,011	2,801	3,723	6,199	6,360
	48.4234	-108.3399	MR-285.2	10,615	6,987	11,262	15,060	19,269	28,142	31,063
	48.4030	**-108.2930**	**MR-281.1**	**10,666**	**7,010**	**11,300**	**15,100**	**19,300**	**28,200**	**31,000**
Milk River: Malta to Dodson *(GI)*	48.3769	-108.2460	MR-276.4	10,668	7,026	11,312	15,106	19,298	28,171	30,967
	48.3744	-108.2206	MR-273.5	10,755	7,732	11,856	15,380	19,208	26,951	29,586
	48.3666	-108.1563	MR-267.2	10,861	8,681	12,547	15,717	19,100	25,548	27,999
	48.3597	-107.9680	MR-247.0	10,900	9,057	12,809	15,842	19,060	25,054	27,441
	48.3434	-107.9479	MR-244.3	10,933	9,386	13,035	15,949	19,027	24,644	26,979
	48.3642	**-107.8606**	**MR-236.0**	**11,163**	**12,000**	**14,700**	**16,700**	**18,800**	**22,000**	**24,000**
	48.4331	-107.8163	MR-225.3	11,220	11,757	14,561	16,651	18,850	22,377	24,310
Milk River: Cree to Malta *(GI)*	48.5441	-107.7555	MR-209.2	11,384	11,093	14,173	16,512	18,994	23,487	25,215
	48.5719	-107.7373	MR-204.8	12,333	8,047	12,208	15,765	19,809	30,676	30,850
	48.6047	-107.6576	MR-196.8	12,463	7,716	11,972	15,670	19,919	31,768	31,675
	48.5405	**-107.5192**	**MR-180.4**	**12,560**	**7,480**	**11,800**	**15,600**	**20,000**	**32,600**	**32,300**
Milk River: Juneberg to Cree *(GI)*	48.5470	-107.4252	MR-172.2	12,571	7,494	11,816	15,617	20,015	32,599	32,300
	48.5462	-107.4235	MR-170.1	13,729	9,002	13,600	17,424	21,588	32,457	32,300
	48.5172	-107.2514	MR-157.0	13,862	9,184	13,811	17,634	21,767	32,442	32,300
Blaine										
Lodge Creek	48.6098	-109.2461	LC-7.6	1,057	4,590	7,570	10,200	13,100	21,814	21,000

Milk River Watershed Hydrologic Analysis: Volume 2

HYDROLOGY NODE DISCHARGE TABLE

Stream	Latitude	Longitude	Node ID	Drainage Area (mi²)	Peak Discharge (cfs) for Annual Exceedance Probability Flows					
					10%	4%	2%	1%	1% plus	0.20%
(RRE)	48.5722	-109.1750	LC-0.1	1,067	4,610	7,610	10,300	13,200	21,980	21,100
Redrock Coulee (RRE)	48.6230	-109.3745	RC-10.9	335	2,260	3,830	5,250	6,870	11,440	11,400
	48.5808	-109.2324	RC-0.6	363.5	2,380	4,020	5,500	7,190	11,973	11,900
Battle Creek (GE)	48.6074	-109.1831	BC-7.9	1,519	2,388	5,404	9,210	14,967	24,922	40,060
	48.5778	-109.1059	BC-0.2	1,556	2,424	5,480	9,335	15,162	25,247	40,541
Thirtymile Creek (RRE)	48.5491	-108.7936	TC-8.9	128	1,249	2,163	3,008	3,991	6,645	6,792
	48.5264	-108.7521	TC-4.4	165	1,459	2,512	3,480	4,601	7,661	7,772
Milk River: Harlem to Havre (Blaine) (GI)	**48.5640**	**-109.6950**	**MR-434.6**	**5,082**	**4,240**	**6,580**	**8,890**	**11,800**	**16,000**	**21,500**
	48.6002	-109.4011	MR-408.4	5,454	4,427	6,855	9,247	12,256	16,619	22,267
	48.5795	-109.2219	MR-393.2	5,826	4,609	7,122	9,593	12,698	17,218	23,007
	48.5611	-109.2064	MR-391.2	5,827	4,610	7,122	9,594	12,699	17,220	23,009
	48.5703	-109.1760	MR-388.7	5,884	4,637	7,163	9,646	12,766	17,310	23,121
	48.5776	-109.1094	MR-382.1	7,024	5,167	7,936	10,646	14,040	19,037	25,244
	48.5737	-109.0177	MR-374.3	8,634	6,100	9,810	13,419	17,813	25,600	32,383
	48.5368	-108.8889	MR-359.1	8,752	6,151	9,888	13,521	17,943	25,787	32,601
Milk River: Dodson to Harlem (GI)	**48.4890**	**-108.7580**	**MR-344.1**	**9,079**	**6,290**	**10,100**	**13,800**	**18,300**	**26,300**	**33,200**
	48.4966	-108.7069	MR-336.3	9,231	6,361	10,218	13,929	18,401	26,490	32,966
	48.4804	-108.5971	MR-323.2	9,289	6,388	10,262	13,977	18,439	26,562	32,878
	48.4427	-108.5137	MR-309.1	9,490	6,480	10,416	14,146	18,570	26,809	32,580
	48.4274	-108.3520	MR-286.6	9,808	6,625	10,659	14,409	18,773	27,194	32,126
Hill										
Big Sandy Creek (GE)	48.5680	-109.8016	BSC-0.0	1796.9	1,726	3,451	5,397	8,064	13,428	18,150
England Coulee (GE)	48.5597	-110.4218	EC-9.3	1.6	73	127	183	256	427	517
	48.5466	-110.4026	EC-7.8	2.1	86	148	213	296	494	592
Beaver Creek near Havre (RRE)	48.4947	-109.7877	BCH-14.4	556	556	897	1,197	1,548	2,577	2,555
	48.5502	-109.7705	BCH-4.4	587	587	946	1,263	1,632	2,717	2,691
	48.5589	-109.7536	BCH-2.3	707	707	1,142	1,526	1,970	3,281	3,238
	48.5647	-109.7284	BCH-0.0	718	718	1,160	1,549	2,001	3,331	3,287
Bullhook Creek Complex (RRE)	48.4947	-109.7877	BCC-0.2	55.5	745	1,310	1,850	2,490	4,146	4,340
Milk River: Havre to Eastern Boundary (GI)	**48.9840**	**-110.4690**	**MR-503.3**	**2,477**	**6,980**	**10,100**	**12,900**	**16,000**	**20,000**	**25,000**
	48.8745	-110.2161	MR-483.1	2,632	7,244	10,461	13,344	16,530	20,663	25,764
	48.8126	-110.1393	MR-475.5	2,773	7,478	10,782	13,737	17,000	21,250	26,440
	48.7351	-110.1208	MR-469.1	2,913	7,707	11,094	14,119	17,456	21,819	27,094
	48.6945	-110.0163	MR-461.9	2,981	7,816	11,243	14,302	17,673	22,091	27,405
	48.6013	-109.9442	MR-453.5	3,067	3,114	4,912	6,710	8,997	12,200	16,736

Milk River Watershed Hydrologic Analysis: Volume 2

HYDROLOGY NODE DISCHARGE TABLE

Stream	Latitude	Longitude	Node ID	Drainage Area (mi²)	Peak Discharge (cfs) for Annual Exceedance Probability Flows					
					10%	4%	2%	1%	1% plus	0.20%
	48.5684	-109.8022	MR-442.0	3,127	3,151	4,967	6,783	9,091	12,327	16,898
	48.5654	-109.7276	MR-436.6	4,950	4,172	6,480	8,761	11,634	15,775	21,221
Milk River: Harlem to Havre (Hill) *(GI)*	**48.5640**	**-109.6950**	**MR-434.6**	**5,082**	**4,240**	**6,580**	**8,890**	**11,800**	**16,000**	**21,500**
	48.5640	-109.5228	MR-420.6	5,182	4,291	6,655	8,987	11,924	16,168	21,709
Missouri River										
	48.0038	**-110.2588**	**MO-27**	**33,326**	**45,200**	**64,500**	**83,500**	**107,000**	**133,000**	**189,000**
	47.9183	-110.0570	MO-26	33,590	45,419	64,796	83,868	107,455	133,565	189,742
	47.7160	-109.8311	MO-25	33,915	45,687	65,158	84,319	108,012	134,258	190,650
	47.7354	-109.6594	MO-24	35,063	46,625	66,426	85,897	109,960	136,679	193,824
	47.7480	-109.5782	MO-23	38,313	49,220	69,924	90,245	115,321	143,343	202,536
	47.7880	-108.9379	MO-22	38,992	49,751	70,638	91,131	116,413	144,700	204,307
	47.6493	-108.7769	MO-21	39,666	48,876	69,564	89,884	115,000	142,944	202,389
	47.6232	-108.6765	MO-20	39,826	48,965	69,686	90,037	115,192	143,182	202,710
	47.6189	-108.5293	MO-19	40,280	49,215	70,030	90,470	115,734	143,856	203,615
Missouri River: Fort Peck Dam to Virgelle *(GI)*	47.6015	-108.4692	MO-18	40,410	49,286	70,127	90,593	115,888	144,047	203,872
	47.5847	-108.1901	MO-17	40,666	49,426	70,320	90,835	116,191	144,425	204,379
	47.5971	-108.1033	MO-16	40,816	49,508	70,433	90,977	116,369	144,645	204,676
	47.4540	-107.9051	MO-15	41,085	49,654	70,634	91,230	116,686	145,039	205,205
	47.4789	-107.8608	MO-14	50,512	54,480	77,258	99,560	127,104	157,989	222,558
	47.6331	-107.6466	MO-13	50,798	54,618	77,448	99,798	127,401	158,358	223,052
	47.6188	-107.4400	MO-12	51,268	54,844	77,758	100,188	127,888	158,963	223,861
	47.6955	-107.3782	MO-11	51,417	54,916	77,856	100,311	128,041	159,154	224,116
	47.6819	-106.8939	MO-10	51,846	55,121	78,138	100,664	128,483	159,703	224,850
	47.9034	-106.5178	MO-09	52,459	55,412	78,537	101,165	129,109	160,481	225,889
	48.0444	**-106.3563**	**MO-08**	**56,487**	**28,900**	**38,000**	**45,900**	**54,800**	**69,400**	**80,000**
	48.0556	-106.3199	MO-07	56,507	28,905	38,006	45,907	54,808	69,410	80,011
Missouri River: Wolf Point to Fort Peck Dam *(GI)*	48.0355	-106.0778	MO-06	78,452	33,522	45,237	55,863	68,377	91,401	107,221
	48.0091	-105.8572	MO-05	78,849	33,598	45,336	55,983	68,520	91,592	107,434
	48.0318	-105.7273	MO-04	79,343	33,692	45,459	56,131	68,697	91,829	107,698
	48.0531	-105.6430	MO-03	79,576	33,736	45,517	56,200	68,781	91,940	107,822
	48.0754	-105.6270	MO-02	79,837	33,786	45,582	56,278	68,874	92,065	107,961
	48.0673	**-105.5331**	**MO-01**	**79,910**	**33,800**	**45,600**	**56,300**	**68,900**	**92,100**	**108,000**

1. Method of analysis is indicated as RRE: Regional regression equation GI : Gage Interpolation or GE: Gage Extraction
2. Values in bold indicate values reported at the gaging station

Appendix B.

USGS Peak-flow Frequency Results

Table 1–1. Information on streamgages for which peak-flow frequency analyses are reported.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. NAD 83, North American Datum of 1983; --, not applicable; U, unregulated; ND, not determined; R, regulated]

Streamgage identification number	Streamgage name	Latitude, in decimal degrees (NAD 83)	Longitude, in decimal degrees (NAD 83)	Type of streamgage[1]	Contributing drainage area, in square miles	Data combination[2]	Data correction[3]	Regulation status[4] as of 2014	Number of recorded peak flows	Water years of recorded peak flows	Number of unregulated peak-flow records	Water years of unregulated peak-flow records	Number of regulated peak-flow records	Water years of regulated peak-flow records	Percentage of drainage basin regulated by dams (2014)	Regulation status for reported at-site peak-flow frequency analyses
06132000	Missouri River below Fork Peck Dam, at Fort Peck, Montana	48.0444	-106.3563	CONT	56,490	--	--	R (MAJ-dam)	86	1934-2018	3	1934-1936	83	1937-2018	98	R (MAJ-dam)
06135000	Milk River at eastern crossing of international boundary	48.9748	-110.4218	CONT	2,452	--	--	R (MAJ-canal)	106	1910-1911, 1913-1915, 1917, 1919-2018	106	1910-1911, 1913-1915, 1917, 1919-2018	0	--	ND	Total
06136400	Spring Coulee tributary near Simpson, Montana	48.9443	-110.2160	CSG	2.76	--	--	U	30	1972, 1974-2002	30	1972, 1974-2002	0	--	0	U
06137600	Sage Creek tributary No. 2 near Joplin, Montana	48.9105	-110.7730	CSG	2.71	--	--	U	45	1974-2018	45	1974-2018	0	--	0	U
06137900	England Coulee at Hingham, Montana	48.5595	-110.4217	CSG	1.61	--	--	U	15	1960-1974	15	1960-1974	0	--	0	U
06138700	South Fork Spring Coulee near Havre, Montana	48.4092	-109.8298	CSG	6.59	--	--	U	53	1960-2012	53	1960-2012	0	--	0	U
06138800	Spring Coulee near Havre, Montana	48.4208	-109.8652	CSG	18.0	--	--	U	15	1959-1973	15	1959-1973	0	--	0	U
06139500	Big Sandy Creek near Havre, Montana	48.5267	-109.8416	CONT, CSG	1,787	--	--	R (MAJ-dam)	58	1946-1953, 1955-1967, 1969, 1978, 1984-2018	0	--	58	1946-1953, 1955-1967, 1969, 1978, 198	72	R (MAJ-dam)
06140000	Beaver Creek near Havre, Montana[5]	48.4807	-109.7770	CONT	88.9	--	--	R (MAJ-dam)	3	1919-1921	3	1919-1921	0	--	0	--
06140400	Bullhook Creek near Havre, Montana	48.5076	-109.6389	CSG	39.1	--	Yes	U	17	1960-1975, 1986	17	1960-1975, 1986	0	--	0	U
06140500	Milk River at Havre, Montana	48.5637	-109.6960	CONT	5,027	--	--	R (MAJ-dam)	90	1899-1922, 1952-1953, 1955-2018	24	1899-1922	66	1952-1953, 1955-2018	88	U, R (MAJ-dam)
06141600	Little Boxelder Creek at mouth, near Havre, Montana	48.5621	-109.5323	CONT	95.9	--	--	U	10	1986-1992, 1994-1996	10	1986-1992, 1994-1996	0	--	2	U
06141900	Milk River tributary near Lohman, Montana	48.5849	-109.4295	CSG	0.18	--	--	U	15	1960-1974	15	1960-1974	0	--	0	U
06142400	Clear Creek near Chinook, Montana	48.5789	-109.3911	CONT	135	--	--	U	35	1984-2018	35	1984-2018	0	--	0	U
06143000	Milk River at Lohman, Montana	48.6017	-109.3999	CONT	5,340	--	--	R (MAJ-dam)	21	1919, 1923, 1925, 1934-1948, 1950-1952	8	1919, 1923, 1925, 1934-1938	13	1939-1948, 1950-1952	82	R (MAJ-dam)
06145550	Lodge Creek below McRae Creek, at international boundary	49.0057	-109.7178	CONT	801	--	--	R (MAJ-dam)	67	1952-2018	0	--	67	1952-2018	ND	R (MAJ-dam)
06149500	Battle Creek at international boundary	49.0016	-109.4225	CONT	839	--	--	R (MAJ-dam)	102	1917-2018	22	1917-1938	80	1939-2018	ND	Total
06151500	Battle Creek near Chinook, Montana	48.6495	-109.2317	CONT	1,468	--	Yes	R (MIN-dams)	52	1905-1914, 1916-1921, 1952, 1984-2018	16	1905-1914, 1916-1921	36	1952, 1984-2018	ND	U, R (MIN-dams)
06153400	Fifteenmile Creek tributary near Zurich, Montana	48.6454	-109.0457	CSG	1.70	--	--	R (MAJ-dam)	45	1974-2018	0	--	45	1974-2018	71	R (MAJ-dam)
06154100	Milk River near Harlem, Montana	48.4896	-108.7590	CONT	8,961	--	--	R (MAJ-dam)	48	1952, 1960-1969, 1978, 1983-2018	0	--	48	1952, 1960-1969, 1978, 1983-2018	64	R (MAJ-dam)
06154400	Peoples Creek near Hays, Montana	48.2237	-108.7141	CONT	227	--	--	U	52	1967-2018	52	1967-2018	0	--	18	U
06154410	Little Peoples Creek near Hays, Montana	47.9658	-108.6607	CONT	12.9	--	--	U	37	1973-2009	37	1973-2009	0	--	0	U
06154430	Lodge Pole Creek at Lodge Pole, Montana	48.0311	-108.5326	CONT	19.5	--	--	U	14	1987-2000	14	1987-2000	0	--	0	U
06154490	Willow Creek near Dodson, Montana	48.3251	-108.4154	CONT	5.53	--	--	U	10	1983-1992	10	1983-1992	0	--	0	U
06154510	Kuhr Coulee tributary near Dodson, Montana	48.3390	-108.3887	CONT, CSG	1.34	--	--	R (MAJ-dam)	36	1983-2018	19	1983-2001	17	2002-2018	90	Total
06154550	Peoples Creek below Kuhr Coulee, near Dodson, Montana	48.3636	-108.3562	CONT	688	--	--	U	50	1906, 1952-1966, 1968-1973, 1982-2009	50	1906, 1952-1966, 1968-1973, 1982-2009	0	--	17	U
06155030	Milk River near Dodson, Montana	48.4028	-108.2941	CONT	10,442	--	--	R (MAJ-dam)	36	1983-2018	0	--	36	1983-2018	59	R (MAJ-dam)
06155100	Black Coulee near Malta, Montana	48.2121	-108.0471	CSG	11.7	--	--	U	13	1956-1967, 1986	13	1956-1967, 1986	0	--	0	U
06155200	Alkali Creek near Malta, Montana	48.2681	-107.9662	CSG	184	--	--	R (MIN-dams)	17	1906, 1956-1959, 1961-1964, 1966, 1968-1973, 1986	1	1906	16	1956-1959, 1961-1964, 1966, 1968-197	38	Total
06155300	Disjardin Coulee near Malta, Montana	48.2760	-107.9643	CSG	3.77	--	--	U	47	1956-2002	47	1956-2002	0	--	0	U
06155400	South Fork Taylor Coulee near Malta, Montana	48.3262	-107.9147	CSG	4.93	--	--	U	18	1956-1973	18	1956-1973	0	--	0	U
06155500	Milk River at Malta, Montana	48.3619	-107.8629	CONT	11,186	--	--	R (MAJ-dam)	26	1903-1909, 1911-1913, 1915-1922, 1952, 1986, 2013-2018	18	1903-1909, 1911-1913, 1915-1922	8	1952, 1986, 2013-2018	57	Total
06155900	Milk River at Cree Crossing, near Saco, Montana	48.5406	-107.5199	CONT	12,337	--	--	R (MAJ-dam)	11	2000-2009, 2011	0	--	11	2000-2009, 2011	52	R (MAJ-dam)
06156000	Whitewater Creek near international boundary	48.9526	-107.8622	CONT	420	--	--	U	52	1927-1933, 1935-1979	52	1927-1933, 1935-1979	0	--	ND	U
06156100	Lush Coulee near Whitewater, Montana	48.6861	-107.6910	CSG	8.90	--	--	U	46	1972, 1974-2018	46	1972, 1974-2018	0	--	0	U
06164000	Frenchman River at international boundary	49.0000	-107.3029	CONT	1,960	--	--	R (MAJ-dam)	102	1917-2018	22	1917-1938	80	1939-2018	ND	Total
06164510	Milk River at Juneberg Bridge, near Saco, Montana	48.5092	-107.2188	CONT	15,713	--	--	R (MAJ-dam)	41	1978-2018	0	--	41	1978-2018	60	R (MAJ-dam)
06164590	Beaver Creek near Zortman, Montana	47.9386	-108.3912	CONT	10.4	--	--	U	9	1984-1992	9	1984-1992	0	--	0	U
06164600	Beaver Creek tributary near Zortman, Montana	47.9275	-108.3527	CSG	3.76	--	--	U	45	1974-2018	45	1974-2018	0	--	0	U
06164615	Little Warm Creek at reservation boundary, near Zortman, Montana	47.9730	-108.3629	CONT	5.75	--	--	U	10	1983-1992	10	1983-1992	0	--	0	U
06164623	Little Warm Creek tributary near Lodge Pole, Montana	47.9952	-108.3201	CONT, CSG	2.39	--	--	U	36	1983-2018	36	1983-2018	0	--	0	U
06164680	Beaver Creek above Dix Creek, near Malta, Montana	48.0884	-107.5555	CONT	914	Yes	--	U	12	1967-1969, 1974, 1976-1982, 1986	12	1967-1969, 1974, 1976-1982, 1986	0	--	0	U
06165200	Guston Coulee near Malta, Montana	48.2419	-107.5486	CSG	2.40	--	--	R (MAJ-dam)	45	1974-2018	0	--	45	1974-2018	0	R (MAJ-dam)
06166000	Beaver Creek below Guston Coulee near Saco, Montana	48.3568	-107.5822	CONT	1,199	Yes	Yes	R (MIN-dams)	38	1920-1921, 1982-1993, 1995-2018	2	1920-1921	36	1982-1993, 1995-2018	29	Total
06167500	Beaver Creek near Hinsdale, Montana	48.4203	-107.1711	CONT	1,678	--	--	R (MIN-dams)	18	1912, 1919-1921, 2005-2018	4	1912, 1919-1921	14	2005-2018	22	Total
06168500	Rock Creek at international boundary	48.9889	-106.7923	CONT	239	--	--	U	35	1927-1961	35	1927-1961	0	--	ND	U
06169000	Horse Creek at international boundary	48.9884	-106.6352	CONT	74.9	--	--	U	46	1915-1933, 1935-1961	46	1915-1933, 1935-1961	0	--	ND	U
06169500	Rock Creek below Horse Creek, near international boundary	48.9694	-106.6398	CONT	322	--	--	U	72	1917, 1919-1926, 1952, 1957-2018	72	1917, 1919-1926, 1952, 1957-2018	0	--	ND	U
06170000	McEachern Creek at international boundary	48.9910	-106.9285	CONT	171	--	--	U	53	1924-1976	53	1924-1976	0	--	ND	U
06170200	Willow Creek near Hinsdale, Montana	48.5650	-106.9825	CONT	290	--	--	U	10	1965-1973, 1979	10	1965-1973, 1979	0	--	1	U
06171000	Rock Creek near Hinsdale, Montana	48.4527	-107.0365	CONT	1,300	--	--	U	11	1906-1907, 1912, 1914-1920, 1952	11	1906-1907, 1912, 1914-1920, 1952	0	--	4	U
06172200	Buggy Creek near Tampico , Montana	48.3608	-106.7779	CONT	124	--	Yes	U	12	1958-1967, 1972, 1982	12	1958-1967, 1972, 1982	0	--	3	U
06172300	Unger Coulee near Vandalia, Montana	48.3707	-106.7974	CSG	10.0	--	--	U	61	1958-2018	61	1958-2018	0	--	15	U
06172310	Milk River at Tampico, Montana	48.3079	-106.8223	CONT	19,142	Yes	--	R (MAJ-dam)	36	1952, 1974-1977, 1988-2018	0	--	36	1952, 1974-1977, 1988-2018	52	Total
06172350	Mooney Coulee near Tampico, Montana	48.2859	-106.7092	CSG	13.8	--	--	U	16	1961-1975, 1982	16	1961-1975, 1982	0	--	0	U
06173300	Willow Creek tributary near Fort Peck, Montana	47.8931	-106.8903	CSG	0.95	--	--	U	19	1972, 1974-1991	19	1972, 1974-1991	0	--	0	U
06174000	Willow Creek near Glasgow, Montana	48.1144	-106.6716	CONT	531	--	--	R (MAJ-dam)	35	1954-1987, 1993	0	--	35	1954-1987, 1993	69	R (MAJ-dam)
06174300	Milk River tributary No. 3 near Glasgow, Montana	48.2047	-106.5523	CSG	1.55	--	--	U	45	1974-2018	45	1974-2018	0	--	0	U
06174500	Milk River at Nashua, Montana	48.1301	-106.3643	CONT	20,254	--	--	R (MAJ-dam)	79	1940-2018	0	--	79	1940-2018	51	R (MAJ-dam)
06175000	Porcupine Creek at Nashua, Montana	48.1359	-106.3423	CONT	724	--	--	U	29	1909-1921, 1923-1924, 1939, 1954, 1982-1993	22	1909-1917, 1954, 1982-1993	7	1918-1921, 1923-1924, 1939	5	U
06177000	Missouri River near Wolf Point, Montana	48.0673	-105.5331	CONT	80,650	--	--	R (MAJ-dam)	90	1929-2018	8	1929-1936	82	1937-2018	84	R (MAJ-dam)

[1] Abbreviations for type of streamgage are defined as follows:
CONT: continuous streamflow operations.
CSG: crest-stage gage operations.
In cases where both CONT and CSG are indicated for an individual streamgage, the historic operations of the streamgage have included periods of continuous streamflow operations and periods of crest-stage gage operations.

[2] Data combination refers to combining peak-flow records of two or more closely located streamgages on the same channel. Information on combining records of multiple streamgages is presented in table 1–2.

[3] Data correction refers to manual adjustment of specific peak-flow records to provide reliable frequency analyses. Information on manual correction of peak-flow records is presented in table 1–3.

[4] Abbreviations for regulation status are defined as follows:
U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.
R (MAJ-dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
R (MAJ-canal): major diversion canal regulation, where a large diversion canal is known to be located on the channel upstream from the streamgage.
R (MAJ-dam): major dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage, but no single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
R (MIN-dams): minor dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage.
Total: the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation, . The "Total" peak-flow frequency analysis is provided in cases where major regulation affects less than 50 percent of the drainage area of the streamgage and there is uncertainty in the effects of regulation on specific peak-flow characteristics. Also, the "Total" peak-flow frequency analysis is the only peak-flow frequency analysis provided in cases of minor dam regulation.

[5] Previous analyses for 06140400 (e.g. Sando and others, 2016) included data from 1966-1986. These peak flow values were found to have been taken from a Soil Conservation Service (SCS) streamgage located upstream of the present location of Beaver Creek Dam. As a result these data have been removed from the peak-flow records for 06140000. Because the remaining peak flow values are insufficient to perform a peak-flow frequency analysis, no analysis for 06140000 is provided in this data release. Previously published peak-flow frequency analyses for this site should not be used.

Reference:
Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2016, Peak-flow frequency analyses and results based on data through water year 2011 for selected streamflow-gaging stations in or near Montana: U.S. Geological Survey Scientific Investigations Report 2015–5019–C, 27 p., http://dx.doi.org/10.3133/sir20155019C.

Table 1–2. Information on analyses combining peak-flow records for two or more closely located streamgages on the same channel

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends.]

Primary streamgage					Secondary streamgage(s) combined with primary streamgage					Combined characteristics	
Streamgage identification number	Streamgage name	Contributing drainage area, in square miles	Number of recorded peak flows	Water years of recorded peak flows	Streamgage identification number	Streamgage name	Drainage area, in square miles	Number of recorded peak flows	Water years of recorded peak flows	Combined number of recorded peak flows	Water years of combined peak-flow records
06164800	Beaver Creek above Dix Creek near Malta, Montana	914	12	1967-1969, 1974, 1976-1982, 1986	06165000	Beaver Creek near Malta, Montana	1,010	5	1917-1921	17	1917-1921, 1967-1969, 1974, 1976-1982, 1986
06166000	Beaver Creek below Guston Coulee near Saco, Montana	1,199	39	1920-1921, 1982-2018	06166500	Beaver Creek near Saco, Montana	1,224	5	1904-1906, 1911-1912	44	1904-1906, 1911-1912, 1920-1921, 1982-2018
06172310	Milk River at Tampico, Montana	19,142	36	1952, 1974-1977, 1988-2018	06172000	Milk River near Vandalia, Montana	18,853	32	1915-1925, 1929-1939, 1952, 1970-1973, 1983-1987	68	1915-1925, 1929-1939, 1952, 1970-1973, 1974-1977, 1983-1987, 1988-2018

Table 1–3. Information on data correction and flow interval representation of specific peak-flow records.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends.]

Streamgage identification number	Streamgage name	Water year	Recorded peak flow, in cubic feet per second	Type of flow interval	Lower interval value, in cubic feet per second	Upper interval value, in cubic feet per second	Comments
06137600	Sage Creek tributary no 2 near Joplin, Montana	2003	2.8	PEAK < STATED VALUE	0	3	
06137600	Sage Creek tributary no 2 near Joplin, Montana	2008	1	PEAK < STATED VALUE	0	1	
06137600	Sage Creek tributary no 2 near Joplin, Montana	2016	1.6	PEAK < STATED VALUE	0	2	
06139500	Big Sandy Creek near Havre, Montana	1988	27.5	PEAK > STATED VALUE	28	6,000	
06139500	Big Sandy Creek near Havre, Montana	1989	62.4	PEAK > STATED VALUE	62	6,000	
06139500	Big Sandy Creek near Havre, Montana	1997	116	PEAK > STATED VALUE	116	6,000	
06140400	Bullhook Creek near Havre, Montana	1986	350	EXCLUSION (OPPORTUNISTIC)	0	INF	Correction of opportunistic peak after the end of systematic record
06142400	Clear Creek near Chinook, Montana	2017	150	PEAK > STATED VALUE	150	INF	
06151500	Battle Creek near Chinook, Montana	1952	9,540	EXCLUSION (OPPORTUNISTIC)	0	19,400	Correction of opportunistic peak in 1986 historical period
06151500	Battle Creek near Chinook, Montana	1984	0.15	PEAK < STATED VALUE	0	0.15	
06151500	Battle Creek near Chinook, Montana	1999	192	PEAK > STATED VALUE	192	19,400	
06151500	Battle Creek near Chinook, Montana	2003	217	PEAK > STATED VALUE	217	19,400	
06151500	Battle Creek near Chinook, Montana	2006	139	PEAK > STATED VALUE	139	19,400	
06153400	Fifteenmile Creek tributary near Zurich, Montana	2006	5	PEAK < STATED VALUE	0	5	
06153400	Fifteenmile Creek tributary near Zurich, Montana	2016	0.93	PEAK < STATED VALUE	0	1	
06155200	Alkali Creek near Malta, Montana	1961	220	PEAK < STATED VALUE	0	220	
06155200	Alkali Creek near Malta, Montana	1966	10	PEAK < STATED VALUE	0	10	
06155200	Alkali Creek near Malta, Montana	1968	10	PEAK < STATED VALUE	0	10	
06155900	Milk River at Cree Crossing near Saco, Montana	2011	7,170	PEAK > STATED VALUE	7,170	INF	Recorded value is from miscellaneous measurement at site
06156100	Lush Coulee near Whitewater, Montana	1987	0	PEAK < CSG BASE	0	4	
06156100	Lush Coulee near Whitewater, Montana	1995	1	PEAK < CSG BASE	0	2	
06156100	Lush Coulee near Whitewater, Montana	1998	0.5	PEAK < CSG BASE	0	2	
06156100	Lush Coulee near Whitewater, Montana	2000	2	PEAK < CSG BASE	0	2	
06156100	Lush Coulee near Whitewater, Montana	2001	0.1	PEAK < CSG BASE	0	2	
06156100	Lush Coulee near Whitewater, Montana	2005	1	PEAK < CSG BASE	0	2	
06156100	Lush Coulee near Whitewater, Montana	2006	2	PEAK < CSG BASE	0	2	
06156100	Lush Coulee near Whitewater, Montana	2007	0.8	PEAK < CSG BASE	0	2	
06156100	Lush Coulee near Whitewater, Montana	2010	2	PEAK < CSG BASE	0	3	
06166000	Beaver Creek below Guston Coulee near Saco, Montana	1904	3,080	EXCLUSION (DAM BREAK)	0	INF	Correction of dam break in 1904
06172200	Buggy Creek near Tampico, Montana	1982	1,540	EXCLUSION (OPPORTUNISTIC)	0	7,660	Correction of opportunistic peak in 1972 historical period

Table 1–4. Documentation regarding analytical procedures for peak-flow frequency analyses.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF, potentially influential low flow; U, unregulated; --, not applicable; R, regulated; MGBT, multiple Grubbs-Beck test; BP, base period used in the Maintenance of Variance Extension Type III record extension]

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Primary reason for deviation from standard Bulletin 17C procedures[4]	Mean	Standard deviation	Skew type used in analysis	Station skew of the peak-flow data	Generalized skew	Source of generalized skew used in weighted skew determinations	Analysis skew used for the frequency analysis	PILF threshold, cubic feet per second	Type of PILF threshold	Number of systematic peak flows equal to zero	Number of non-zero systematic peak flows less than PILF threshold	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)
06132000.10	Missouri River below Fort Peck Dam, Montana	56,490	R (MAJ–dam)	At-site	82	1937-2018	reg	4.195	0.200	Station	0.539	--	--	0.539	--	MGBT	0	0	--
06135000.20	Milk River at Eastern Crossing of International Boundary	2,452	Total	At-site	106	1910-1911, 1913-1915, 1917, 1919-2018	--	3.420	0.329	Weighted	0.104	-0.099	Bulletin 17B[5]	0.079	--	MGBT	0	0	--
06136400.00	Spring Coulee tributary near Simpson, Montana	2.76	U	At-site	30	1972, 1974-2002	--	0.493	0.838	Weighted	-0.857	-0.130	Bulletin 17B[5]	-0.324	2.0	MGBT	12	0	YES
06136400.03	Spring Coulee tributary near Simpson, Montana	2.76	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06137600.00	Sage Creek tributary no 2 near Joplin, Montana	2.71	U	At-site	45	1974-2018	--	0.629	0.902	Weighted	-0.631	-0.023	Bulletin 17B[5]	-0.221	2.5	MGBT	12	5	--
06137600.03	Sage Creek tributary no 2 near Joplin, Montana	2.71	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06137900.00	England Coulee at Hingham, Montana	1.61	U	At-site	15	1960-1974	--	1.267	0.459	Weighted	2.773	-0.016	Bulletin 17B[5]	0.231	14	MGBT	3	2	--
06137900.03	England Coulee at Hingham, Montana	1.61	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06138700.00	South Fork Spring Coulee near Havre, Montana	6.59	U	At-site	53	1960-2012	--	1.188	0.679	Weighted	-1.084	-0.082	Bulletin 17B[5]	-0.313	13	MGBT	4	20	--
06138700.03	South Fork Spring Coulee near Havre, Montana	6.59	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06138800.00	Spring Coulee near Havre, Montana	18.0	U	At-site	15	1959-1973	--	1.269	1.130	Weighted	-0.942	-0.083	Bulletin 17B[5]	-0.340	2.0	MGBT	3	0	--
06138800.03	Spring Coulee near Havre, Montana	18.0	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06139500.10	Big Sandy Creek near Havre, Montana	1,787	R (MAJ–dam)	At-site	58	1946-1953, 1955-1967, 1969, 1978, 1984-2018	--	2.398	0.654	Weighted	0.000	-0.107	Bulletin 17B[5]	-0.030	42	MGBT	0	7	YES
06140400.00	Bullhook Creek near Havre, Montana	39.1	U	At-site	16	1960-1975, 1986	--	1.978	0.513	Weighted	0.287	-0.132	Bulletin 17B[5]	0.014	47	MGBT	2	2	--
06140400.03	Bullhook Creek near Havre, Montana	39.1	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06140500.00	Milk River at Havre, Montana	5,027	U	At-site	24	1899-1922	--	3.544	0.398	Weighted	-0.543	-0.135	Bulletin 17B[5]	-0.385	--	MGBT	0	0	--
06140500.10	Milk River at Havre, Montana	5,027	R (MAJ–dam)	At-site	66	1952-1953, 1955-2018	reg	3.197	0.325	Station	0.508	--	--	0.508	1,515	FIXED	0	32	YES
06141600.00	Little Box Elder Creek at Mouth near Havre, Montana	95.9	U	At-site	10	1986-1992, 1994-1996	--	2.057	0.550	Weighted	0.269	-0.157	Bulletin 17B[5]	0.032	--	MGBT	0	0	--
06141600.03	Little Box Elder Creek at Mouth near Havre, Montana	95.9	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06141900.00	Milk River Tributary near Lohman, Montana	0.18	U	At-site	15	1960-1974	--	-0.108	1.188	Weighted	-0.231	-0.175	Bulletin 17B[5]	-0.188	0.40	MGBT	6	0	--
06141900.03	Milk River Tributary near Lohman, Montana	0.18	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06142400.00	Clear Creek near Chinook, Montana	135	U	At-site	35	1984-2018	--	2.042	0.454	Weighted	0.520	-0.179	Bulletin 17B[5]	0.228	38	MGBT	0	4	--
06142400.03	Clear Creek near Chinook, Montana	135	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06143000.10	Milk River at Lohman, Montana	5,340	R (MAJ–dam)	At-site	13	1939-1948, 1950-1952	reg	3.087	0.297	Station	0.841	--	--	0.841	--	MGBT	0	0	YES
06145500.10	Lodge Creek below McRae Creek, at International boundary	801	R (MAJ–dam)	At-site	67	1952-2018	reg	2.516	0.896	Station	-1.038	--	--	-1.038	164	MGBT	3	18	YES
06149500.20	Battle Creek at international boundary	839	Total	At-site	102	1917-2018	--	2.651	0.577	Weighted	-0.657	-0.250	Bulletin 17B[5]	-0.485	165	MGBT	0	23	YES
06151500.00	Battle Creek near Chinook, Montana	1,468	U	At-site	16	1905-1914, 1916-1921	--	3.357	0.529	Weighted	-0.548	-0.213	Bulletin 17B[5]	-0.391	--	MGBT	0	0	YES
06151500.10	Battle Creek near Chinook, Montana	1,468	R (MIN–dams)	At-site	36	1952, 1984-2018	--	2.428	0.730	Weighted	0.181	-0.213	Bulletin 17B[5]	0.076	17	MGBT	0	1	YES
06153400.10	Fifteenmile Creek tributary near Zurich, Montana	1.70	R (MAJ–dam)	At-site	45	1974-2018	--	0.990	0.763	Weighted	-0.164	-0.237	Bulletin 17B[5]	-0.203	3.0	MGBT	9	2	--
06154100.10	Milk River near Harlem, Montana	8,961	R (MAJ–dam)	At-site	48	1952, 1960-1969, 1978, 1983-2018	--	3.290	0.391	Weighted	0.444	-0.245	Bulletin 17B[5]	0.225	--	MGBT	0	0	YES
06154400.00	Peoples Creek near Hays, Montana	227	U	At-site	52	1967-2018	--	2.239	0.701	Weighted	-0.101	-0.209	Bulletin 17B[5]	-0.126	--	MGBT	0	0	YES
06154400.03	Peoples Creek near Hays, Montana	227	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06154410.00	Little Peoples Creek near Hays, Montana	12.9	U	At-site	37	1973-2009	--	1.672	0.532	Weighted	-0.251	-0.173	Bulletin 17B[5]	-0.230	--	MGBT	0	0	--
06154410.03	Little Peoples Creek near Hays, Montana	12.9	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06154430.00	Lodge Pole Creek at Lodge Pole, Montana	19.5	U	At-site	14	1987-2000	--	1.659	0.472	Weighted	-0.375	-0.201	Bulletin 17B[5]	-0.275	10	MGBT	0	1	--
06154430.03	Lodge Pole Creek at Lodge Pole, Montana	19.5	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06154490.00	Willow Coulee near Dodson, Montana	5.53	U	At-site	10	1983-1992	--	1.580	1.101	Weighted	-0.544	-0.258	Bulletin 17B[5]	-0.368	--	MGBT	0	0	YES
06154490.03	Willow Coulee near Dodson, Montana	5.53	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06154510.20	Kuhr Coulee Tributary near Dodson, Montana	1.34	Total	At-site	32	1983-2018	--	1.345	0.681	Weighted	-0.083	-0.263	Bulletin 17B[5]	-0.174	6.9	MGBT	2	5	--
06154510.23	Kuhr Coulee Tributary near Dodson, Montana	1.34	Total	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06154550.00	Peoples Creek below Kuhr Coulee near Dodson, Montana	688	U	At-site	50	1906, 1952-1966, 1968-1973, 1982-2009	--	2.681	0.544	Weighted	-0.222	-0.271	Bulletin 17B[5]	-0.235	--	MGBT	0	0	YES
06154550.03	Peoples Creek below Kuhr Coulee near Dodson, Montana	688	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06155030.10	Milk River near Dodson, Montana	10,442	R (MAJ–dam)	At-site	36	1983-2018	--	3.161	0.534	Weighted	-0.501	-0.283	Bulletin 17B[5]	-0.425	--	MGBT	0	0	YES
06155030.11	Milk River near Dodson, Montana	10,442	R (MAJ–dam)	MOVE3	41	1978-2018	--	3.166	0.552	Weighted	-0.451	-0.283	Bulletin 17B[5]	-0.399	--	MGBT	0	0	YES
06155100.00	Black Coulee near Malta, Montana	11.7	U	At-site	13	1956-1967, 1986	--	2.029	0.521	Weighted	0.879	-0.284	Bulletin 17B[5]	0.050	--	MGBT	0	0	YES
06155100.03	Black Coulee near Malta, Montana	11.7	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06155200.20	Alkali Creek near Malta, Montana	184	Total	At-site	17	1906, 1956-1959, 1961-1964, 1966, 1968-1973, 1986	--	2.339	0.718	Weighted	3.286	-0.301	Bulletin 17B[5]	-0.217	245	MGBT	0	7	YES
06155300.00	Disjardin Coulee near Malta, Montana	3.77	U	At-site	47	1956-2002	--	1.458	0.563	Weighted	1.000	-0.302	Bulletin 17B[5]	0.434	7.0	MGBT	5	0	--
06155300.03	Disjardin Coulee near Malta, Montana	3.77	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06155400.00	Taylor Coulee near Malta, Montana	4.93	U	At-site	18	1956-1973	--	0.988	0.853	Weighted	-0.889	-0.312	Bulletin 17B[5]	-0.422	8.0	MGBT	4	4	--
06155400.03	Taylor Coulee near Malta, Montana	4.93	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06155500.20	Milk River at Malta, Montana	11,186	Total	At-site	26	1903-1909, 1911-1913, 1915-1922, 1952, 1986, 2013-2018	--	3.840	0.186	Weighted	0.493	-0.321	Bulletin 17B[5]	0.015	5,460	MGBT	0	7	YES
06155900.10	Milk River at Cree Crossing near Saco, Montana	12,337	R (MAJ–dam)	At-site	11	2000-2009, 2011	--	3.110	0.409	Weighted	1.335	-0.362	Bulletin 17B[5]	-0.072	564	MGBT	0	1	YES
06155900.11	Milk River at Cree Crossing near Saco, Montana	12,337	R (MAJ–dam)	MOVE3	41	1978-2018	--	3.270	0.483	Weighted	-0.220	-0.362	Bulletin 17B[5]	-0.260	--	MGBT	0	0	YES
06156000.00	Whitewater Creek near international boundary	420	U	At-site	52	1927-1933, 1935-1979	lower tail	2.295	0.769	Weighted	-0.581	-0.394	Bulletin 17B[5]	-0.488	123	FIXED	0	19	YES
06156000.03	Whitewater Creek near international boundary	420	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06156100.00	Lush Coulee near Whitewater, Montana	8.90	U	At-site	46	1972, 1974-2018	--	1.113	0.976	Weighted	-0.506	-0.368	Bulletin 17B[5]	-0.441	--	MGBT	0	0	YES
06156100.03	Lush Coulee near Whitewater, Montana	8.90	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06164000.20	Frenchman River at international boundary	1,960	Total	At-site	102	1917-2018	reg	3.065	0.369	Station	0.234	--	--	0.234	450	FIXED	0	15	YES
06164510.10	Milk River at Juneberg Bridge near Saco, Montana	15,713	R (MAJ–dam)	At-site	41	1978-2018	--	3.358	0.476	Weighted	-0.262	-0.377	Bulletin 17B[5]	-0.296	--	MGBT	0	0	YES
06164510.11	Milk River at Juneberg Bridge near Saco, Montana	15,713	R (MAJ–dam)	MOVE3	101	1915-1925, 1929-2018	reg	3.523	0.492	Station	-0.746	--	--	-0.746	2,180	MGBT	0	32	YES
06164590.00	Beaver Creek near Zortman, Montana	10.4	U	At-site	9	1984-1992	--	1.131	0.569	Weighted	1.619	-0.200	Bulletin 17B[5]	0.337	--	MGBT	0	0	--

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Primary reason for deviation from standard Bulletin 17C procedures[4]	Mean	Standard deviation	Skew type used in analysis	Station skew of the peak-flow data	Generalized skew	Source of generalized skew used in weighted skew determinations	Analysis skew used for the frequency analysis	PILF threshold, cubic feet per second	Type of PILF threshold	Number of systematic peak flows equal to zero	Number of non-zero systematic peak flows less than PILF threshold	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)
06164590.03	Beaver Creek near Zortman, Montana	10.4	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06164600.00	Beaver Creek tributary near Zortman, Montana	3.76	U	At-site	45	1974-2018	--	1.801	0.636	Weighted	0.270	-0.202	Bulletin 17B[5]	0.125	9.0	MGBT	3	0	--
06164600.03	Beaver Creek tributary near Zortman, Montana	3.76	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06164615.00	Little Warm Creek at Reservation Boundary near Zortman, Montana	5.75	U	At-site	10	1983-1992	--	1.654	0.698	Weighted	1.159	-0.211	Bulletin 17B[5]	0.308	--	MGBT	0	0	--
06164615.03	Little Warm Creek at Reservation Boundary near Zortman, Montana	5.75	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06164623.00	Little Warm Creek Tributary near Lodge Pole, Montana	2.39	U	At-site	36	1983-2018	--	1.853	0.649	Weighted	-0.362	-0.221	Bulletin 17B[5]	-0.321	--	MGBT	0	0	--
06164623.03	Little Warm Creek Tributary near Lodge Pole, Montana	2.39	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06164800.00	Beaver Creek above Dix Creek near Malta, Montana	914	U	At-site	17	1917-1921, 1967-1969, 1974, 1976-1982, 1986	lower tail	3.039	0.714	Weighted	-1.063	-0.321	Bulletin 17B[5]	-0.556	346	FIXED	0	4	YES
06164800.03	Beaver Creek above Dix Creek near Malta, Montana	914	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06165200.10	Guston Coulee near Malta, Montana	2.40	R (MAJ–dam)	At-site	45	1974-2018	--	0.364	0.853	Weighted	-0.768	-0.335	Bulletin 17B[5]	-0.461	2.0	MGBT	18	2	--
06165200.13	Guston Coulee near Malta, Montana	2.40	R (MAJ–dam)	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06166000.20	Beaver Creek below Guston Coulee near Saco, Montana	1,199	Total	At-site	42	1904-1906, 1911-1912, 1920-1921, 1982-1993, 1995-2018	--	2.755	0.608	Weighted	-0.024	-0.342	Bulletin 17B[5]	-0.102	61	MGBT	0	2	YES
06167500.20	Beaver Creek near Hinsdale, Montana	1,678	Total	At-site	18	1912, 1919-1921, 2005-2018	--	3.196	0.423	Weighted	-0.424	-0.377	Bulletin 17B[5]	-0.390	--	MGBT	0	2	YES
06167500.21	Beaver Creek near Hinsdale, Montana	1,678	Total	MOVE3	43	1905-1906, 1911-1912, 1919-1921, 1982-1993, 1995-2018	--	3.100	0.433	Weighted	-0.136	-0.377	Bulletin 17B[5]	-0.200	227	MGBT	0	2	YES
06168500.00	Rock Creek at international boundary	239	U	At-site	35	1927-1961	--	2.721	0.466	Weighted	-0.445	-0.400	Bulletin 17B[5]	-0.431	--	MGBT	0	0	--
06168500.01	Rock Creek at international boundary	239	U	MOVE3	47	1915-1961	--	2.749	0.435	Weighted	-0.572	-0.400	Bulletin 17B[5]	-0.525	--	MGBT	0	0	--
06169000.00	Horse Creek at international boundary	74.9	U	At-site	46	1915-1933, 1935-1961	--	2.423	0.515	Weighted	-0.712	-0.400	Bulletin 17B[5]	-0.598	32	MGBT	0	2	YES
06169000.01	Horse Creek at international boundary	74.9	U	MOVE3	103	1915-1933, 1935-2018	--	2.357	0.495	Weighted	-0.734	-0.400	Bulletin 17B[5]	-0.582	107	MGBT	0	25	YES
06169500.00	Rock Creek below Horse Creek near International boundary	322	U	At-site	72	1917, 1919-1926, 1952, 1957-2018	--	2.858	0.455	Weighted	-0.842	-0.399	Bulletin 17B[5]	-0.607	350	MGBT	0	17	YES
06169500.01	Rock Creek below Horse Creek near International boundary	322	U	MOVE3	103	1915-1933, 1935-2018	--	2.914	0.423	Weighted	-0.530	-0.399	Bulletin 17B[5]	-0.480	419	MGBT	0	24	YES
06170000.00	McEachern Creek at international boundary	171	U	At-site	53	1924-1976	--	2.756	0.557	Weighted	-0.516	-0.400	Bulletin 17B[5]	-0.473	118	MGBT	0	6	YES
06170000.03	McEachern Creek at international boundary	171	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06170200.00	Willow Creek near Hinsdale, Montana	290	U	At-site	10	1965-1973, 1979	--	3.313	0.479	Weighted	0.107	-0.391	Bulletin 17B[5]	-0.202	--	MGBT	0	0	YES
06170200.03	Willow Creek near Hinsdale, Montana	290	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06171000.00	Rock Creek near Hinsdale, Montana	1,300	U	At-site	11	1906-1907, 1912, 1914-1920, 1952	--	3.630	0.192	Weighted	0.989	-0.387	Bulletin 17B[5]	-0.184	--	MGBT	0	0	YES
06171000.03	Rock Creek near Hinsdale, Montana	1,300	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06172200.00	Buggy Creek near Tampico, Montana	124	U	At-site	11	1958-1967, 1972, 1982	--	2.770	0.540	Weighted	0.501	-0.390	Bulletin 17B[5]	-0.203	452	MGBT	1	3	YES
06172200.03	Buggy Creek near Tampico, Montana	124	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06172300.00	Unger Creek near Vandalia, Montana	10.0	U	At-site	61	1958-2018	--	1.788	0.776	Weighted	-0.134	-0.390	Bulletin 17B[5]	-0.216	10	MGBT	6	3	--
06172300.03	Unger Creek near Vandalia, Montana	10.0	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06172310.20	Milk River at Tampico, Montana	19,142	Total	At-site	67	1915-1925, 1929-1939, 1952, 1970-1977, 1983-2018	--	3.720	0.433	Weighted	-0.590	-0.389	Bulletin 17B[5]	-0.518	1,370	MGBT	0	7	YES
06172310.21	Milk River at Tampico, Montana	19,142	Total	MOVE3	101	1915-1925, 1929-2018	--	3.735	0.381	Weighted	-0.432	-0.389	Bulletin 17B[5]	-0.412	3,800	MGBT	0	33	YES
06172350.00	Mooney Coulee near Tampico, Montana	13.8	U	At-site	16	1961-1975, 1982	--	1.625	0.642	Weighted	-0.082	-0.390	Bulletin 17B[5]	-0.289	17	MGBT	2	2	YES
06172350.03	Mooney Coulee near Tampico, Montana	13.8	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06173300.00	Willow Creek tributary near Fort Peck, Montana	0.95	U	At-site	19	1972, 1974-1991	--	1.791	0.465	Weighted	2.253	-0.361	Bulletin 17B[5]	-0.085	51	MGBT	2	5	YES
06173300.03	Willow Creek tributary near Fort Peck, Montana	0.95	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06174000.10	Willow Creek near Glasgow, Montana	531	R (MAJ–dam)	At-site	35	1954-1987, 1993	reg	3.167	0.578	Station	-0.817	--	--	-0.817	468	MGBT	0	6	YES
06174300.00	Milk River tributary no 3 near Glasgow, Montana	1.55	U	At-site	45	1974-2018	--	1.414	0.580	Weighted	0.051	-0.391	Bulletin 17B[5]	-0.218	23	MGBT	12	8	--
06174300.03	Milk River tributary no 3 near Glasgow, Montana	1.55	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06174500.10	Milk River at Nashua, Montana	20,254	R (MAJ–dam)	At-site	79	1940-2018	--	3.765	0.332	Weighted	-0.172	-0.394	Bulletin 17B[5]	-0.260	4,160	MGBT	0	25	YES
06174500.11	Milk River at Nashua, Montana	20,254	R (MAJ–dam)	MOVE3	101	1915-1925, 1929-2018	--	3.817	0.358	Weighted	-0.300	-0.394	Bulletin 17B[5]	-0.334	4,160	MGBT	0	28	YES
06175000.00	Porcupine Creek at Nashua, Montana	724	U	At-site	22	1909-1917, 1954, 1982-1993	--	2.805	0.560	Weighted	0.499	-0.394	Bulletin 17B[5]	0.039	196	MGBT	0	3	YES
06175000.03	Porcupine Creek at Nashua, Montana	724	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06177000.10	Missouri River near Wolf Point, Montana	80,650	R (MAJ–dam)	At-site	82	1937-2018	reg	4.276	0.189	Station	0.924	--	--	0.924	--	MGBT	0	0	--

[1]The streamgage identification number and analysis designation is defined by XXXXXXXX.AB,
where,
XXXXXXXX is the streamgage identification number;
A is the regulation status for the analysis period; and
B is the type of peak-flow frequency analysis.

Values of A (regulation status) are defined as:
A = 0, unregulated;
A = 1, regulated by major regulation; and
A = 2, total; that is, the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation (see footnote 2).

Values of B (type of peak-flow frequency analysis) are defined as:
B = 0, at-site peak-flow frequency analysis conducted on recorded data;
B = 1, at-site peak-flow frequency analysis conducted on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
B = 2, peak-flow frequency analysis determined from regional regression equations (RREs); RRE frequency results not presented in this report; and
B = 3, at-site peak-flow frequency analysis weighted with results from RREs; distributional parameters not available for RRE weighted frequency analyses.

[2]Abbreviations for regulation status are defined as follows:
U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.
R (MAJ–dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
R (MAJ–canal): major diversion canal regulation, where a large diversion canal is known to be located on the channel upstream from the streamgage.
R (MIN–dams): minor dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage, but no single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
Total: the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation, . The "Total" peak-flow frequency analysis is provided in cases where major regulation affects less than 50 percent of the drainage area of the streamgage and there is uncertainty in the effects of regulation on specific peak-flow characteristics. Also, the "Total" peak-flow frequency analysis is the only peak-flow frequency analysis provided in cases of minor dam regulation.

Streamgage identification number and analysis designation [1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis [2]	Type of peak-flow frequency analysis [3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Primary reason for deviation from standard Bulletin 17C procedures [4]	Log-distribution information for peak-flow data							Potentially Influential Low Flood (PILF) information				Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)
								Mean	Standard deviation	Skew type used in analysis	Station skew of the peak-flow data	Generalized skew	Source of generalized skew used in weighted skew determinations	Analysis skew used for the frequency analysis	PILF threshold, cubic feet per second	Type of PILF threshold	Number of systematic peak flows equal to zero	Number of non-zero systematic peak flows less than PILF threshold	

[3]Abbreviations for type of frequency analysis are defined as follows:

At-site: peak-flow frequency analysis on recorded data.

RRE wtd: the at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs).

MOVE.3: peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure.

[4]Standard Bulletin 17C (England and others, 2019) procedures are considered to be the use of the weighted skew and the use of the multiple Grubbs-Beck low-outlier test (MGBT) for identifying PILFs. In cases where either the station skew or a manual (analyst-selected) PILF threshold was used, the peak-flow frequency analysis was considered to deviate from standard Bulletin 17C procedures. The abbreviations for the reasons for deviation from standard Bulletin 17C procedures are defined as follows:

reg: the peak-flow records are affected by major dam or canal regulation;

upper tail: the probability plots of the peak-flow records deviate from typical patterns in the upper tail of the frequency curve, generally because of mixed population characteristics; and

lower tail: the probability plots of the peak-flow records deviate from typical patterns in the lower tail of the frequency curve at high annual exceedance probabilities (greater than about 50.0 percent).

[5]U.S. Interagency Advisory Council on Water Data, 1982, Guidelines for determining flood flow frequency: Hydrology Subcommittee, Bulletin 17B, appendixes 1–14, 28 p.

Table 1–5. Documentation of user-defined perception thresholds for peaks represented as flow intervals (excluding missing data periods) in applicable peak-flow frequency analyses.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. U, unregulated; --, not applicable]

Streamgage identification number and analysis designation[1]	Streamgage name	Regulation status for analysis[2]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Perception threshold period, in water years	Lower bound of perceptible range, in cubic feet per second	Upper bound of perceptible range, in cubic feet per second	Water year of peak flow used for historical perception threshold	Peak flow used for historical perception threshold, in cubic feet per second	Comments
06136400.00	Spring Coulee tributary near Simpson, Montana	U	30	1972, 1974-2002	1972-1973	35	INF	1972	35	1972 HISTORICAL PERIOD
06137600.00	Sage Creek tributary no 2 near Joplin, Montana	U	45	1974-2018	2003	3	INF	--	--	PEAK < STATED VALUE
06137600.00	Sage Creek tributary no 2 near Joplin, Montana	U	45	1974-2018	2008	1	INF	--	--	PEAK < STATED VALUE
06137600.00	Sage Creek tributary no 2 near Joplin, Montana	U	45	1974-2018	2016	2	INF	--	--	PEAK < STATED VALUE
06139500.10	Big Sandy Creek near Havre, Montana	R (MAJ–dam)	58	1946-1953, 1955-1967, 1969, 1978, 1984-2018	1968-1969	2,600	INF	1969	2,600	1969 HISTORICAL PERIOD
06139500.10	Big Sandy Creek near Havre, Montana	R (MAJ–dam)	58	1946-1953, 1955-1967, 1969, 1978, 1984-2018	1954	6,000	INF	1978	6,000	1978 HISTORICAL PERIOD
06139500.10	Big Sandy Creek near Havre, Montana	R (MAJ–dam)	58	1946-1953, 1955-1967, 1969, 1978, 1984-2018	1970-1983	6,000	INF	1978	6,000	1978 HISTORICAL PERIOD
06140500.10	Milk River at Havre, Montana	R (MAJ–dam)	66	1952-1953, 1955-2018	1954	11,400	INF	1952	11,400	1952 HISTORICAL PERIOD
06140500.10	Milk River at Havre, Montana	R (MAJ–dam)	66	1952-1953, 1955-2018	1900-1951	11,400	INF	1952	11,400	1952 HISTORICAL PERIOD
06143000.10	Milk River at Lohman, Montana	R (MAJ–dam)	13	1939-1948, 1950-1952	1949	3,450	INF	1939	3,450	1939 HISTORICAL PERIOD
06143000.10	Milk River at Lohman, Montana	R (MAJ–dam)	13	1939-1948, 1950-1952	1953-2018	11,400	INF	1952	11,400	1952 HISTORICAL PERIOD
06143000.10	Milk River at Lohman, Montana	R (MAJ–dam)	13	1939-1948, 1950-1952	1900-1938	11,400	INF	1952	11,400	1952 HISTORICAL PERIOD
06145500.10	Lodge Creek below McRae Creek, at International boundary	R (MAJ–dam)	67	1952-2018	1927-1951	9,890	INF	1952	9,890	1952 HISTORICAL PERIOD
06149500.20	Battle Creek at international boundary	Total	102	1917-2018	1905-1916	9,780	INF	1986	9,780	1986 HISTORICAL PERIOD
06151500.10	Battle Creek near Chinook, Montana	U	16	1905-1914, 1916-1921	1915	19,400	INF	1986	19,400	1986 HISTORICAL PERIOD
06151500.10	Battle Creek near Chinook, Montana	R (MAJ–dam)	36	1952, 1984-2018	1905-1983	19,400	INF	1986	19,400	1986 HISTORICAL PERIOD
06151500.10	Battle Creek near Chinook, Montana	R (MAJ–dam)	36	1952, 1984-2018	1984	0.15	INF	--	--	PEAK < STATED VALUE
06153400.10	Fifteenmile Creek tributary near Zurich, Montana	R (MAJ–dam)	45	1974-2018	2006	5	INF	--	--	PEAK < STATED VALUE
06153400.10	Fifteenmile Creek tributary near Zurich, Montana	R (MAJ–dam)	45	1974-2018	2016	1	INF	--	--	PEAK < STATED VALUE
06154100.10	Milk River near Harlem, Montana	R (MAJ–dam)	48	1952, 1960-1969, 1978, 1983-2018	1952-1959	19,000	INF	1952	19,000	1952 HISTORICAL PERIOD
06154100.10	Milk River near Harlem, Montana	R (MAJ–dam)	48	1952, 1960-1969, 1978, 1983-2018	1978-1982	9,800	INF	1978	9,800	1978 HISTORICAL PERIOD
06154100.10	Milk River near Harlem, Montana	R (MAJ–dam)	48	1952, 1960-1969, 1978, 1983-2018	1970-1977	9,800	INF	1978	9,800	1978 HISTORICAL PERIOD
06154100.10	Milk River near Harlem, Montana	R (MAJ–dam)	48	1952, 1960-1969, 1978, 1983-2018	1939-1951	19,000	INF	1952	19,000	1952 HISTORICAL PERIOD
06154400.00	Peoples Creek near Hays, Montana	U	52	1967-2018	1939-1966	8,460	INF	1972	8,460	1972 HISTORICAL PERIOD
06154490.00	Willow Coulee near Dodson, Montana	U	10	1983-1992	1993-2009	2,310	INF	1986	2,310	1986 HISTORICAL PERIOD
06154550.00	Peoples Creek below Kuhr Coulee near Dodson, Montana	U	50	1906, 1952-1966, 1968-1973, 1982-2009	1906-1951	4,500	INF	1906	4,500	1906 HISTORICAL PERIOD
06154550.00	Peoples Creek below Kuhr Coulee near Dodson, Montana	U	50	1906, 1952-1966, 1968-1973, 1982-2009	1967	7,590	INF	1986	7,590	1986 HISTORICAL PERIOD
06154550.00	Peoples Creek below Kuhr Coulee near Dodson, Montana	U	50	1906, 1952-1966, 1968-1973, 1982-2009	1974-1981	7,590	INF	1986	7,590	1986 HISTORICAL PERIOD
06155030.10	Milk River near Dodson, Montana	R (MAJ–dam)	36	1983-2018	1953-1982	13,200	INF	1986	13,200	1986 HISTORICAL PERIOD
06155030.11	Milk River near Dodson, Montana	R (MAJ–dam)	41	1978-2018	1953-1977	13,200	INF	1986	13,200	1986 HISTORICAL PERIOD
06155100.00	Black Coulee near Malta, Montana	U	13	1956-1967, 1986	1968-1986	2,350	INF	1986	2,350	1986 HISTORICAL PERIOD
06155200.20	Alkali Creek near Malta, Montana	Total	17	1906, 1956-1959, 1961-1964, 1966, 1968-1973, 1986	1906-1955	5,300	INF	1906	5,300	1906 HISTORICAL PERIOD
06155200.20	Alkali Creek near Malta, Montana	Total	17	1906, 1956-1959, 1961-1964, 1966, 1968-1973, 1986	1974-1986	5,300	INF	1906	5,300	1906 HISTORICAL PERIOD
06155200.20	Alkali Creek near Malta, Montana	Total	17	1906, 1956-1959, 1961-1964, 1966, 1968-1973, 1986	1960	5,300	INF	1906	5,300	1906 HISTORICAL PERIOD
06155200.20	Alkali Creek near Malta, Montana	Total	17	1906, 1956-1959, 1961-1964, 1966, 1968-1973, 1986	1965	5,300	INF	1906	5,300	1906 HISTORICAL PERIOD
06155200.20	Alkali Creek near Malta, Montana	Total	17	1906, 1956-1959, 1961-1964, 1966, 1968-1973, 1986	1967	5,300	INF	1906	5,300	1906 HISTORICAL PERIOD
06155200.20	Alkali Creek near Malta, Montana	Total	17	1906, 1956-1959, 1961-1964, 1966, 1968-1973, 1986	1987-2018	22,900	INF	1986	22,900	1986 HISTORICAL PERIOD
06155500.20	Milk River at Malta, Montana	Total	26	1903-1909, 1911-1913, 1915-1922, 1952, 1986, 2013-2018	1952-1978	24,000	INF	1952	24,000	1952 HISTORICAL PERIOD
06155500.20	Milk River at Malta, Montana	Total	26	1903-1909, 1911-1913, 1915-1922, 1952, 1986, 2013-2018	1910	24,000	INF	1952	24,000	1952 HISTORICAL PERIOD
06155500.20	Milk River at Malta, Montana	Total	26	1903-1909, 1911-1913, 1915-1922, 1952, 1986, 2013-2018	1914	24,000	INF	1952	24,000	1952 HISTORICAL PERIOD
06155500.20	Milk River at Malta, Montana	Total	26	1903-1909, 1911-1913, 1915-1922, 1952, 1986, 2013-2018	1923-1951	24,000	INF	1952	24,000	1952 HISTORICAL PERIOD
06155500.20	Milk River at Malta, Montana	Total	26	1903-1909, 1911-1913, 1915-1922, 1952, 1986, 2013-2018	1979-2012	14,800	INF	1986	14,800	1986 HISTORICAL PERIOD
06155900.10	Milk River at Cree Crossing near Saco, Montana	R (MAJ–dam)	11	2000-2009, 2011	2011	7,170	INF	2011	7,170	2011 HISTORICAL PERIOD
06155900.10	Milk River at Cree Crossing near Saco, Montana	R (MAJ–dam)	11	2000-2009, 2011	2010	7,170	INF	2011	7,170	2011 HISTORICAL PERIOD
06155900.10	Milk River at Cree Crossing near Saco, Montana	R (MAJ–dam)	11	2000-2009, 2011	2012-2016	7,170	INF	2011	7,170	2011 HISTORICAL PERIOD
06155900.11	Milk River at Cree Crossing near Saco, Montana	R (MAJ–dam)	41	1978-2018	1953-1977	20,400	INF	1978	20,400	1978 HISTORICAL PERIOD
06156000.00	Whitewater Creek near international boundary	U	52	1927-1933, 1935-1979	1934	1,810	INF	1928	1,810	1928 HISTORICAL PERIOD
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	1972-1973	178	INF	1972	178	1972 HISTORICAL PERIOD
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	1974-1975	2	INF	--	--	CSG ZERO = 2 CFS
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	1976-1978	3	INF	--	--	CSG ZERO = 3 CFS

Streamgage identification number and analysis designation[1]	Streamgage name	Regulation status for analysis[2]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Perception threshold period, in water years	Lower bound of perceptible range, in cubic feet per second	Upper bound of perceptible range, in cubic feet per second	Water year of peak flow used for historical perception threshold	Peak flow used for historical perception threshold, in cubic feet per second	Comments
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	1979-1981	4	INF	--	--	CSG ZERO = 4 CFS
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	1982	5	INF	--	--	CSG ZERO = 5 CFS
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	1983	6	INF	--	--	CSG ZERO = 6 CFS
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	1984-1987	4	INF	--	--	CSG ZERO = 4 CFS
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	1988-2007	2	INF	--	--	CSG ZERO = 2 CFS
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	2010-2011	3	INF	--	--	CSG ZERO = 3 CFS
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	2012-2014	7	INF	--	--	CSG ZERO = 7 CFS
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	2015	8	INF	--	--	CSG ZERO = 8 CFS
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	2016	5	INF	--	--	CSG ZERO = 5 CFS
06156100.00	Lush Coulee near Whitewater, Montana	U	46	1972, 1974-2018	2017-2018	4	INF	--	--	CSG ZERO = 4 CFS
06164000.20	Frenchman River at international boundary	Total	102	1917-2018	1906-1916	22,700	INF	1952	22,700	1952 HISTORICAL PERIOD
06164510.10	Milk River at Juneberg Bridge near Saco, Montana	R (MAJ–dam)	41	1978-2018	1953-1977	12,400	INF	1978	12,400	1978 HISTORICAL PERIOD
06164510.11	Milk River at Juneberg Bridge near Saco, Montana	R (MAJ–dam)	101	1915-1925, 1929-2018	1926-1928	32,800	INF	1952	32,800	1952 HISTORICAL PERIOD
06164800.00	Beaver Creek above Dix Creek near Malta, Montana	U	17	1917-1921, 1967-1969, 1974, 1976-1982, 1986	1970-1975	5,290	INF	1974	5,290	1974 HISTORICAL PERIOD
06164800.00	Beaver Creek above Dix Creek near Malta, Montana	U	17	1917-1921, 1967-1969, 1974, 1976-1982, 1986	1922-1966	26,500	INF	1986	26,500	1986 HISTORICAL PERIOD
06164800.00	Beaver Creek above Dix Creek near Malta, Montana	U	17	1917-1921, 1967-1969, 1974, 1976-1982, 1986	1983-2018	26,500	INF	1986	26,500	1986 HISTORICAL PERIOD
06166000.20	Beaver Creek below Guston Coulee near Saco, Montana	Total	42	1904-1906, 1911-1912, 1920-1921, 1982-1993, 1995-2018	1906-1910	6,650	INF	1906	6,650	1906 HISTORICAL PERIOD
06166000.20	Beaver Creek below Guston Coulee near Saco, Montana	Total	42	1904-1906, 1911-1912, 1920-1921, 1982-1993, 1995-2018	1913-1919	6,650	INF	1906	6,650	1906 HISTORICAL PERIOD
06166000.20	Beaver Creek below Guston Coulee near Saco, Montana	Total	42	1904-1906, 1911-1912, 1920-1921, 1982-1993, 1995-2018	1922-1952	6,650	INF	1906	6,650	1906 HISTORICAL PERIOD
06166000.20	Beaver Creek below Guston Coulee near Saco, Montana	Total	42	1904-1906, 1911-1912, 1920-1921, 1982-1993, 1995-2018	1953-1981	23,500	INF	1986	23,500	1986 HISTORICAL PERIOD
06166000.20	Beaver Creek below Guston Coulee near Saco, Montana	Total	42	1904-1906, 1911-1912, 1920-1921, 1982-1993, 1995-2018	1994	23,500	INF	1986	23,500	1986 HISTORICAL PERIOD
06167500.20	Beaver Creek near Hinsdale, Montana	Total	18	1912, 1919-1921, 2005-2018	1912-1918	4,630	INF	1912	4,630	1912 HISTORICAL PERIOD
06167500.20	Beaver Creek near Hinsdale, Montana	Total	18	1912, 1919-1921, 2005-2018	1987-2004	8,210	INF	2011	8,210	2011 HISTORICAL PERIOD
06167500.21	Beaver Creek near Hinsdale, Montana	Total	43	1905-1906, 1911-1912, 1919-1921, 1982-1993, 1995-2018	1907-1910	4,630	INF	1912	4,630	1912 HISTORICAL PERIOD
06167500.21	Beaver Creek near Hinsdale, Montana	Total	43	1905-1906, 1911-1912, 1919-1921, 1982-1993, 1995-2018	1913-1918	4,630	INF	1912	4,630	1912 HISTORICAL PERIOD
06167500.21	Beaver Creek near Hinsdale, Montana	Total	43	1905-1906, 1911-1912, 1919-1921, 1982-1993, 1995-2018	1922-1952	7,210	INF	1906	7,210	1906 HISTORICAL PERIOD
06167500.21	Beaver Creek near Hinsdale, Montana	Total	43	1905-1906, 1911-1912, 1919-1921, 1982-1993, 1995-2018	1953-1981	17,400	INF	1986	17,400	1986 HISTORICAL PERIOD
06167500.21	Beaver Creek near Hinsdale, Montana	Total	43	1905-1906, 1911-1912, 1919-1921, 1982-1993, 1995-2018	1994	17,400	INF	1986	17,400	1986 HISTORICAL PERIOD
06169000.00	Horse Creek at international boundary	U	46	1915-1933, 1935-1961	1934	1,040	INF	1925	1,040	1925 HISTORICAL PERIOD
06169000.01	Horse Creek at international boundary	U	103	1915-1933, 1935-2018	1934	1,040	INF	1925	1,040	1925 HISTORICAL PERIOD
06169500.00	Rock Creek below Horse Creek near International boundary	U	72	1917, 1919-1926, 1952, 1957-2018	1918	5,110	INF	1952	5,110	1952 HISTORICAL PERIOD
06169500.00	Rock Creek below Horse Creek near International boundary	U	72	1917, 1919-1926, 1952, 1957-2018	1927-1956	5,110	INF	1952	5,110	1952 HISTORICAL PERIOD
06169500.01	Rock Creek below Horse Creek near International boundary	U	103	1915-1933, 1935-2018	1934	3,610	INF	1925	3,610	1925 HISTORICAL PERIOD
06170000.00	McEachern Creek at international boundary	U	53	1924-1976	1977-2018	7,080	INF	1952	7,080	1952 HISTORICAL PERIOD
06170200.00	Willow Creek near Hinsdale, Montana	U	10	1965-1973, 1979	1974-1985	12,000	INF	1979	12,000	1979 HISTORICAL PERIOD
06171000.00	Rock Creek near Hinsdale, Montana	U	11	1906-1907, 1912, 1914-1920, 1952	1908-1911	12,900	INF	1952	12,900	1952 HISTORICAL PERIOD
06171000.00	Rock Creek near Hinsdale, Montana	U	11	1906-1907, 1912, 1914-1920, 1952	1913	12,900	INF	1952	12,900	1952 HISTORICAL PERIOD
06171000.00	Rock Creek near Hinsdale, Montana	U	11	1906-1907, 1912, 1914-1920, 1952	1921-1952	12,900	INF	1952	12,900	1952 HISTORICAL PERIOD
06172200.00	Buggy Creek near Tampico, Montana	U	11	1958-1967, 1972, 1982	1968-2018	7,660	INF	1972	7,660	1972 HISTORICAL PERIOD
06172310.20	Milk River at Tampico, Montana	Total	67	1915-1925, 1929-1939, 1952, 1970-1977, 1983-2018	1952-1969	45,000	INF	1952	45,000	1952 HISTORICAL PERIOD
06172310.20	Milk River at Tampico, Montana	Total	67	1915-1925, 1929-1939, 1952, 1970-1977, 1983-2018	1978-1982	45,000	INF	1952	45,000	1952 HISTORICAL PERIOD
06172310.20	Milk River at Tampico, Montana	Total	67	1915-1925, 1929-1939, 1952, 1970-1977, 1983-2018	1899-1914	45,000	INF	1952	45,000	1952 HISTORICAL PERIOD
06172310.20	Milk River at Tampico, Montana	Total	67	1915-1925, 1929-1939, 1952, 1970-1977, 1983-2018	1926-1928	45,000	INF	1952	45,000	1952 HISTORICAL PERIOD
06172310.20	Milk River at Tampico, Montana	Total	67	1915-1925, 1929-1939, 1952, 1970-1977, 1983-2018	1940-1951	45,000	INF	1952	45,000	1952 HISTORICAL PERIOD
06172310.21	Milk River at Tampico, Montana	Total	101	1915-1925, 1929-2018	1952	45,000	INF	1952	45,000	1952 HISTORICAL PERIOD
06172310.21	Milk River at Tampico, Montana	Total	101	1915-1925, 1929-2018	1899-1914	45,000	INF	1952	45,000	1952 HISTORICAL PERIOD
06172310.21	Milk River at Tampico, Montana	Total	101	1915-1925, 1929-2018	1926-1928	45,000	INF	1952	45,000	1952 HISTORICAL PERIOD
06172350.00	Mooney Coulee near Tampico, Montana	U	16	1961-1975, 1982	1976-1982	450	INF	1982	450	1982 HISTORICAL PERIOD
06173300.00	Willow Creek tributary near Fort Peck, Montana	U	19	1972, 1974-1991	1972-1973	940	INF	1972	940	1972 HISTORICAL PERIOD
06174000.10	Willow Creek near Glasgow, Montana	R (MAJ–dam)	35	1954-1987, 1993	1988-1993	4,850	INF	1993	4,850	1993 HISTORICAL PERIOD
06174500.10	Milk River at Nashua, Montana	R (MAJ–dam)	79	1940-2018	1899-1939	45,300	INF	1952	45,300	1952 HISTORICAL PERIOD

Streamgage identification number and analysis designation[1]	Streamgage name	Regulation status for analysis[2]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Perception threshold period, in water years	Lower bound of perceptible range, in cubic feet per second	Upper bound of perceptible range, in cubic feet per second	Water year of peak flow used for historical perception threshold	Peak flow used for historical perception threshold, in cubic feet per second	Comments
06174500.11	Milk River at Nashua, Montana	R (MAJ–dam)	101	1915-1925, 1929-2018	1926-1928	45,300	INF	1952	45,300	1952 HISTORICAL PERIOD
06174500.11	Milk River at Nashua, Montana	R (MAJ–dam)	101	1915-1925, 1929-2018	1899-1914	45,300	INF	1952	45,300	1952 HISTORICAL PERIOD
06175000.00	Porcupine Creek at Nashua, Montana	U	22	1909-1917, 1954, 1982-1993	1940-1981	15,300	INF	1954	15,300	1954 HISTORICAL PERIOD

[1]The streamgage identification number and analysis designation is defined by XXXXXXXX.AB,

where,

XXXXXXXX is the streamgage identification number;

A is the regulation status for the analysis period; and

B is the type of peak-flow frequency analysis.

Values of A (regulation status) are defined as:

A = 0, unregulated;

A = 1, regulated by major regulation; and

A = 2, total; that is, the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation (see footnote 2).

Values of B (type of peak-flow frequency analysis) are defined as:

B = 0, at-site peak-flow frequency analysis conducted on recorded data;

B = 1, peak-flow frequency analysis conducted on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;

B = 2, peak-flow frequency analysis determined from regional regression equations (RREs); RRE frequency results not presented in this report; and

B = 3, at-site peak-flow frequency analysis weighted with results from RREs; distributional parameters not available for RRE weighted frequency analyses.

[2]Abbreviations for regulation status are defined as follows:

U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.

R (MAJ–dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.

R (MAJ–canal): major diversion canal regulation, where a large diversion canal is known to be located on the channel upstream from the streamgage.

R (MIN–dams): minor dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage, but no single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.

Total: the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation, . The "Total" peak-flow frequency analysis is provided in cases where major regulation affects less than 50 percent of the drainage area of the streamgage and there is uncertainty in the effects of regulation on specific peak-flow characteristics. Also, the "Total" peak-flow frequency analysis is the only peak-flow frequency analysis provided in cases of minor dam regulation.

Table 1–6. Documentation regarding the Maintenance of Variance Type III (MOVE.3) record extension procedure for selected streamgages.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. SEP, standard error of prediction, in percent; --, not applicable]

Streamgage identification number	Streamgage Name	Contributing drainage area, in square miles	Number of recorded peak flows	Water years of recorded peak flows	Number of years requiring synthesis of peak flows	Water years requiring synthesis of peak flows	Percentage of record synthesized	Index streamgage(s) used for synthesis of peak streamflows								
								Streamgage identification number	Streamgage Name	Contributing drainage area, in square miles	Number of peak flows synthesized based on this streamgage	Number of concurrent recorded peak flows for target and index streamgages	Pearson correlation coefficient for concurrent data for target and index streamgage	Weighted average Pearson correlation coefficient[1]	Estimated standard error of MOVE.3 analysis, in percent[2]	Effective record length for the synthesized peak flows
06155030	Milk River near Dodson, Montana	10,442	36	1983-2018	5	1978-1982	12.2	06164510	Milk River at Juneberg Bridge near Saco, Montana	15,713	5	36	0.89	0.89	67.3	2.8
06155900	Milk River at Cree Crossing near Saco, Montana	12,337	10	2000-2009	31	1978-1999, 2010-2018	75.6	06155030	Milk River near Dodson, Montana	10,442	26	10	0.96	0.96	28.4	13.4
								06164510	Milk River at Juneberg Bridge near Saco, Montana	15,713	5	10	0.96			3.5
06164510	Milk River at Juneberg Bridge near Saco, Montana	15,713	41	1978-2018	60	1915-1925, 1929-1977	59.4	06172310	Milk River at Tampico, Montana	19,142	22	36	0.88	0.88	64.3	10.0
								06174500	Milk River at Nashua, Montana	20,254	38	41	0.88			15.8
06167500	Beaver Creek near Hinsdale, Montana	1,805	18	1912, 1919-1921, 2005-2018	25	1905-1906, 1911, 1982-1993, 1995-2004	58.1	06166000	Beaver Creek below Guston Coulee near Saco, Montana	1,199	25	17	0.90	0.90	51.7	9.5
06168500	Rock Creek at international boundary	239	35	1927-1961	12	1915-1926	25.5	06169000	Horse Creek at international boundary	74.9	12	34	0.89	0.89	65.2	6.4
06169000	Horse Creek at international boundary	74.9	46	1915-1933, 1935-1961	57	1962-2018	55.3	06169500	Rock Creek below Horse Creek near international boundary	322	57	15	0.96	0.96	41.4	27.4
06169500	Rock Creek below Horse Creek near international boundary	322	72	1917, 1919-1926, 1952, 1957-2018	31	1915-1916, 1918, 1927-1933, 1935-1951, 1953-1956	30.1	06169000	Horse Creek at international boundary	74.9	31	15	0.96	0.96	35.7	18.4
06172310	Milk River at Tampico, Montana	19,142	67	1915-1925, 1929-1939, 1952, 1970-1977, 1983-2018	34	1940-1951, 1953-1969, 1978-1982	33.7	06174500	Milk River at Nashua, Montana	20,254	34	45	0.93	0.93	43.4	20.3
06174500	Milk River at Nashua, Montana	20,254	79	1940-2018	22	1915-1925, 1929-1939	21.8	06172310	Milk River at Tampico, Montana	19,142	22	45	0.93	0.93	44.3	14.0

[1]The weighted average Pearson correlation coefficient was determined by multiplying the number of peak flows synthesized based on an index streamgage times the Pearson correlation coefficient for the index streamgage for each index streamgage. The resultant products then were summed and divided by the total number of synthesized peak flows.

[2]A standard error was calculated based on an ordinary least squares (OLS) formulation of the analysis. That OLS standard error was adjusted to an estimated MOVE.3 formulation by multiplying times the following adjustment factor (Wilbert O. Thomas, Michael Baker International, written commun., November 2016):

$AF = 2/(1+\rho)$,

where,

AF is the adjustment factor; and

ρ is the weighted average Pearson correlation coefficient.

Table 1–7. Peak-flow frequency results.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. U, unregulated; R, regulated; --, not applicable; BP, base period used in the Maintenance of Variance Type III record extension]

Streamgage identification number and analysis designation [1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis [2]	Type of peak-flow frequency analysis [3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)	Annual peak flow, in cubic feet per second, for indicated annual exceedance probability, in percent									84 percent confidence level for the 1 percent annual exceedance probability peak flow	Analyses considered by U.S. Geological Survey to be most appropriate for flood-plain mapping purposes [4]
								50	42.9	20	10	4	2	1	0.5	0.2		
06132000.10	Missouri River below Fort Peck Dam, Montana	56,490	R (MAJ–dam)	At-site	82	1937-2018	--	15,000	16,300	22,700	28,900	38,000	45,900	54,800	64,800	80,000	69,400	Yes
06135000.20	Milk River at Eastern Crossing of International Boundary	2,452	Total	At-site	106	1910-1911, 1913-1915, 1917, 1919-2018	--	2,600	2,980	4,960	6,980	10,100	12,900	16,000	19,600	25,000	20,000	Yes
06136400.00	Spring Coulee tributary near Simpson, Montana	2.76	U	At-site	30	1972, 1974-2002	YES	3.5	4.8	16	34	73	116	174	250	380	514	Yes
06136400.03	Spring Coulee tributary near Simpson, Montana	2.76	U	RRE wtd	--	--	--	5.1	6.8	24	58	141	230	339	473	692	535	--
06137600.00	Sage Creek tributary no 2 near Joplin, Montana	2.71	U	At-site	45	1974-2018	--	4.6	6.6	25	58	137	236	379	581	963	887	--
06137600.03	Sage Creek tributary no 2 near Joplin, Montana	2.71	U	RRE wtd	--	--	--	5.8	8.1	31	76	177	285	424	598	894	654	Yes
06137900.00	England Coulee at Hingham, Montana	1.61	U	At-site	15	1960-1974	--	18	21	44	73	127	184	257	352	519	799	--
06137900.03	England Coulee at Hingham, Montana	1.61	U	RRE wtd	--	--	--	16	20	44	77	145	217	308	421	612	490	Yes
06138700.00	South Fork Spring Coulee near Havre, Montana	6.59	U	At-site	53	1960-2012	--	17	22	59	108	200	293	408	548	773	756	Yes
06138700.03	South Fork Spring Coulee near Havre, Montana	6.59	U	RRE wtd	--	--	--	18	23	64	125	251	383	542	733	1,040	798	--
06138800.00	Spring Coulee near Havre, Montana	18.0	U	At-site	15	1959-1973	--	22	34	172	468	1,290	2,400	4,110	6,610	11,500	22,800	--
06138800.03	Spring Coulee near Havre, Montana	18.0	U	RRE wtd	--	--	--	34	50	191	396	758	1,100	1,530	2,040	2,860	2,460	Yes
06139500.10	Big Sandy Creek near Havre, Montana	1,787	R (MAJ–dam)	At-site	58	1946-1953, 1955-1967, 1969, 1978, 1984-2018	YES	252	330	891	1,720	3,440	5,380	8,040	11,600	18,100	13,600	Yes
06140400.00	Bullhook Creek near Havre, Montana	39.1	U	At-site	16	1960-1975, 1986	--	95	117	257	433	757	1,090	1,500	2,030	2,910	3,720	--
06140400.03	Bullhook Creek near Havre, Montana	39.1	U	RRE wtd	--	--	--	96	119	276	495	918	1,340	1,840	2,430	3,370	2,830	Yes
06140500.00	Milk River at Havre, Montana	5,027	U	At-site	24	1899-1922	--	3,710	4,350	7,650	10,800	15,300	18,900	22,600	26,600	32,000	34,600	--
06140500.10	Milk River at Havre, Montana	5,027	R (MAJ–dam)	At-site	66	1952-1953, 1955-2018	YES	1,480	1,690	2,880	4,240	6,580	8,890	11,800	15,400	21,500	16,000	Yes
06141600.00	Little Box Elder Creek at Mouth near Havre, Montana	95.9	U	At-site	10	1986-1992, 1994-1996	--	113	142	330	580	1,060	1,570	2,240	3,090	4,590	6,930	--
06141600.03	Little Box Elder Creek at Mouth near Havre, Montana	95.9	U	RRE wtd	--	--	--	120	151	356	617	1,070	1,480	1,960	2,520	3,410	3,130	Yes
06141900.00	Milk River Tributary near Lohman, Montana	0.18	U	At-site	15	1960-1974	--	0.8	1.4	8.0	24	78	163	310	554	1,100	4,280	--
06141900.03	Milk River Tributary near Lohman, Montana	0.18	U	RRE wtd	--	--	--	1.5	2.3	9.5	22	48	74	110	154	233	185	Yes
06142400.00	Clear Creek near Chinook, Montana	135	U	At-site	35	1984-2018	--	106	128	262	430	744	1,070	1,490	2,030	2,980	2,770	--
06142400.03	Clear Creek near Chinook, Montana	135	U	RRE wtd	--	--	--	109	132	285	495	910	1,330	1,840	2,450	3,430	2,730	Yes
06143000.10	Milk River at Lohman, Montana	5,340	R (MAJ–dam)	At-site	13	1939-1948, 1950-1952	YES	1,110	1,250	2,070	3,040	4,790	6,600	8,950	12,000	17,500	13,100	--[5]
06145500.10	Lodge Creek below McRae Creek, at International boundary	801	R (MAJ–dam)	At-site	67	1952-2018	YES	466	653	1,900	3,310	5,310	6,810	8,220	9,510	11,000	11,400	--
06149500.20	Battle Creek at international boundary	839	Total	At-site	102	1917-2018	YES	498	627	1,400	2,260	3,620	4,800	6,100	7,510	9,520	7,930	Yes
06151500.00	Battle Creek near Chinook, Montana	1,468	U	At-site	16	1905-1914, 1916-1921	YES	2,460	3,050	6,450	10,200	16,200	21,400	27,200	33,600	42,900	53,200	--
06151500.10	Battle Creek near Chinook, Montana	1,468	R (MIN–dams)	At-site	36	1952, 1984-2018	YES	262	354	1,090	2,340	5,300	9,040	14,700	22,900	39,400	25,500	--
06153400.10	Fifteenmile Creek tributary near Zurich, Montana	1.70	R (MAJ–dam)	At-site	45	1974-2018	--	10	14	44	89	186	297	447	645	996	865	Yes
06154100.10	Milk River near Harlem, Montana	8,961	R (MAJ–dam)	At-site	48	1952, 1960-1969, 1978, 1983-2018	YES	1,880	2,210	4,110	6,290	10,100	13,800	18,300	23,900	33,200	26,300	Yes
06154400.00	Peoples Creek near Hays, Montana	227	U	At-site	52	1967-2018	YES	180	239	682	1,340	2,730	4,280	6,390	9,180	14,200	10,600	Yes
06154400.03	Peoples Creek near Hays, Montana	227	U	RRE wtd	--	--	--	188	250	709	1,370	2,630	3,860	5,360	7,120	9,920	7,640	--
06154410.00	Little Peoples Creek near Hays, Montana	12.9	U	At-site	37	1973-2009	--	49	61	133	218	363	499	659	846	1,140	1,090	Yes
06154410.03	Little Peoples Creek near Hays, Montana	12.9	U	RRE wtd	--	--	--	48	60	130	212	349	477	629	807	1,090	903	--
06154430.00	Lodge Pole Creek at Lodge Pole, Montana	19.5	U	At-site	14	1987-2000	--	48	58	115	177	275	361	458	566	726	944	--
06154430.03	Lodge Pole Creek at Lodge Pole, Montana	19.5	U	RRE wtd	--	--	--	48	59	121	196	327	450	594	758	1,010	904	Yes
06154490.00	Willow Coulee near Dodson, Montana	5.53	U	At-site	10	1983-1992	YES	44	69	332	871	2,300	4,150	6,920	10,800	18,300	23,600	--
06154490.03	Willow Coulee near Dodson, Montana	5.53	U	RRE wtd	--	--	--	34	49	157	300	545	775	1,060	1,410	1,970	1,690	--
06154510.20	Kuhr Coulee Tributary near Dodson, Montana	1.34	Total	At-site	32	1983-2018	--	23	31	84	160	313	477	693	971	1,450	1,410	Yes
06154510.23	Kuhr Coulee Tributary near Dodson, Montana	1.34	Total	RRE wtd	--	--	--	21	28	70	124	218	312	434	583	833	656	--
06154550.00	Peoples Creek below Kuhr Coulee near Dodson, Montana	688	U	At-site	50	1906, 1952-1966, 1968-1973, 1982-2009	YES	504	629	1,400	2,310	3,880	5,360	7,120	9,180	12,400	9,790	Yes
06154550.03	Peoples Creek below Kuhr Coulee near Dodson, Montana	688	U	RRE wtd	--	--	--	512	640	1,430	2,390	4,050	5,630	7,480	9,600	12,800	9,790	--
06155030.10	Milk River near Dodson, Montana	10,442	R (MAJ–dam)	At-site	36	1983-2018	YES	1,580	1,960	4,150	6,560	10,300	13,600	17,200	21,100	26,700	24,300	--
06155030.11	Milk River near Dodson, Montana	10,442	R (MAJ–dam)	MOVE3	41	1978-2018	YES	1,590	1,990	4,340	7,010	11,300	15,100	19,300	24,100	31,000	28,200	Yes
06155100.00	Black Coulee near Malta, Montana	11.7	U	At-site	13	1956-1967, 1986	YES	106	131	293	501	891	1,300	1,820	2,480	3,630	3,700	--
06155100.03	Black Coulee near Malta, Montana	11.7	U	RRE wtd	--	--	--	92	112	240	395	671	944	1,290	1,700	2,380	1,930	Yes
06155200.20	Alkali Creek near Malta, Montana	184	Total	At-site	17	1906, 1956-1959, 1961-1964, 1966, 1968-1973, 1986	YES	232	310	890	1,740	3,470	5,350	7,830	11,000	16,500	45,700	--
06155300.00	Disjardin Coulee near Malta, Montana	3.77	U	At-site	47	1956-2002	--	26	33	82	159	333	550	878	1,370	2,380	1,920	--
06155300.03	Disjardin Coulee near Malta, Montana	3.77	U	RRE wtd	--	--	--	26	32	81	154	302	459	663	919	1,360	1,010	--
06155400.00	Taylor Coulee near Malta, Montana	4.93	U	At-site	18	1956-1973	--	11	16	52	108	224	348	507	704	1,030	3,780	--
06155400.03	Taylor Coulee near Malta, Montana	4.93	U	RRE wtd	--	--	--	16	21	64	136	283	428	606	818	1,160	983	--
06155500.20	Milk River at Malta, Montana	11,186	Total	At-site	26	1903-1909, 1911-1913, 1915-1922, 1952, 1986, 2013-2018	YES	6,900	7,450	9,910	12,000	14,700	16,700	18,800	21,000	24,000	22,000	Yes
06155900.10	Milk River at Cree Crossing near Saco, Montana	12,337	R (MAJ–dam)	At-site	11	2000-2009, 2011	YES	1,300	1,540	2,850	4,270	6,530	8,570	10,900	13,600	17,800	22,000	--
06155900.11	Milk River at Cree Crossing near Saco, Montana	12,337	R (MAJ–dam)	MOVE3	41	1978-2018	YES	1,960	2,380	4,800	7,480	11,800	15,600	20,000	24,900	32,300	32,600	Yes
06156000.00	Whitewater Creek near international boundary	420	U	At-site	52	1927-1933, 1935-1979	YES	228	310	898	1,700	3,190	4,640	6,370	8,400	11,500	11,100	--
06156000.03	Whitewater Creek near international boundary	420	U	RRE wtd	--	--	--	250	337	978	1,890	3,570	5,150	6,970	9,020	12,100	10,100	Yes
06156100.00	Lush Coulee near Whitewater, Montana	8.90	U	At-site	46	1972, 1974-2018	YES	15	23	89	204	463	759	1,160	1,680	2,560	2,420	Yes
06156100.03	Lush Coulee near Whitewater, Montana	8.90	U	RRE wtd	--	--	--	18	26	98	217	453	690	984	1,340	1,900	1,480	--
06164000.20	Frenchman River at international boundary	1,960	Total	At-site	102	1917-2018	YES	1,120	1,310	2,350	3,520	5,500	7,400	9,720	12,500	17,100	13,500	Yes
06164510.10	Milk River at Juneberg Bridge near Saco, Montana	15,713	R (MAJ–dam)	At-site	41	1978-2018	YES	2,410	2,920	5,810	8,940	13,800	18,200	23,000	28,400	36,200	31,900	--
06164510.11	Milk River at Juneberg Bridge near Saco, Montana	15,713	R (MAJ–dam)	MOVE3	101	1915-1925, 1929-2018	YES	3,840	4,650	8,800	12,600	17,600	21,300	24,800	28,200	32,300	32,200	Yes
06164590.00	Beaver Creek near Zortman, Montana	10.4	U	At-site	9	1984-1992	--	13	16	40	75	155	251	392	597	1,000	1,650	Yes

Annual peak flow, in cubic feet per second, for indicated annual exceedance probability, in percent

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)	50	42.9	20	10	4	2	1	0.5	0.2	84 percent confidence level for the 1 percent annual exceedance probability peak flow	Analyses considered by U.S. Geological Survey to be most appropriate for flood-plain mapping purposes[4]
06164590.03	Beaver Creek near Zortman, Montana	10.4	U	RRE wtd	--	--	--	16	21	62	127	254	378	530	713	1,020	858	--
06164600.00	Beaver Creek tributary near Zortman, Montana	3.76	U	At-site	45	1974-2018	--	61	80	215	421	874	1,410	2,180	3,270	5,360	4,480	Yes
06164600.03	Beaver Creek tributary near Zortman, Montana	3.76	U	RRE wtd	--	--	--	56	72	178	309	525	733	997	1,320	1,870	1,500	--
06164615.00	Little Warm Creek at Reservation Boundary near Zortman, Montana	5.75	U	At-site	10	1983-1992	--	42	55	169	370	885	1,590	2,720	4,500	8,420	14,400	Yes
06164615.03	Little Warm Creek at Reservation Boundary near Zortman, Montana	5.75	U	RRE wtd	--	--	--	37	48	125	228	415	603	845	1,140	1,640	1,360	--
06164623.00	Little Warm Creek Tributary near Lodge Pole, Montana	2.39	U	At-site	36	1983-2018	--	77	100	256	457	823	1,180	1,620	2,140	2,960	2,910	Yes
06164623.03	Little Warm Creek Tributary near Lodge Pole, Montana	2.39	U	RRE wtd	--	--	--	66	84	196	315	488	642	835	1,060	1,440	1,220	--
06164800.00	Beaver Creek above Dix Creek near Malta, Montana	914	U	At-site	17	1917-1921, 1967-1969, 1974, 1976-1982, 1986	YES	1,270	1,690	4,470	7,950	13,900	19,200	25,300	32,100	41,900	48,600	--
06164800.03	Beaver Creek above Dix Creek near Malta, Montana	914	U	RRE wtd	--	--	--	1,170	1,530	3,830	6,370	10,200	13,600	17,400	21,700	28,100	26,100	Yes
06165200.10	Guston Coulee near Malta, Montana	2.40	R (MAJ–dam)	At-site	45	1974-2018	--	2.7	3.8	12	26	52	79	114	156	224	282	Yes
06165200.13	Guston Coulee near Malta, Montana	2.40	R (MAJ–dam)	RRE wtd	--	--	--	3.9	5.2	17	41	102	170	252	350	507	391	--
06166000.20	Beaver Creek below Guston Coulee near Saco, Montana	1,199	Total	At-site	42	1904-1906, 1911-1912, 1920-1921, 1982-1993, 1995-2018	YES	582	747	1,860	3,360	6,270	9,330	13,300	18,300	26,900	19,700	Yes
06167500.20	Beaver Creek near Hinsdale, Montana	1,678	Total	At-site	18	1912, 1919-1921, 2005-2018	YES	1,670	1,980	3,610	5,220	7,530	9,420	11,400	13,500	16,400	16,400	--
06167500.21	Beaver Creek near Hinsdale, Montana	1,678	Total	MOVE3	43	1905-1906, 1911-1912, 1919-1921, 1982-1993, 1995-2018	YES	1,300	1,550	2,940	4,420	6,740	8,780	11,100	13,700	17,500	16,200	Yes
06168500.00	Rock Creek at international boundary	239	U	At-site	35	1927-1961	--	569	686	1,320	1,960	2,910	3,700	4,530	5,410	6,640	6,760	--
06168500.01	Rock Creek at international boundary	239	U	MOVE3	47	1915-1961	--	612	728	1,320	1,890	2,670	3,260	3,910	4,540	5,380	5,510	Yes
06169000.00	Horse Creek at international boundary	74.9	U	At-site	46	1915-1933, 1935-1961	YES	298	366	732	1,100	1,620	2,040	2,470	2,900	3,480	3,480	--
06169000.01	Horse Creek at international boundary	74.9	U	MOVE3	103	1915-1933, 1935-2018	YES	254	309	604	896	1,310	1,640	1,970	2,310	2,760	2,630	Yes
06169500.00	Rock Creek below Horse Creek near International boundary	322	U	At-site	72	1917, 1919-1926, 1952, 1957-2018	YES	802	960	1,770	2,540	3,570	4,360	5,150	5,930	6,950	6,290	--
06169500.01	Rock Creek below Horse Creek near International boundary	322	U	MOVE3	103	1915-1933, 1935-2018	YES	888	1,050	1,890	2,690	3,810	4,690	5,590	6,520	7,760	6,980	Yes
06170000.00	McEachern Creek at international boundary	171	U	At-site	53	1924-1976	YES	630	788	1,710	2,720	4,310	5,670	7,160	8,780	11,100	9,500	Yes
06170000.03	McEachern Creek at international boundary	171	U	RRE wtd	--	--	--	604	753	1,610	2,530	3,960	5,180	6,540	8,020	10,200	8,360	--
06170200.00	Willow Creek near Hinsdale, Montana	290	U	At-site	10	1965-1973, 1979	YES	2,130	2,590	5,240	8,220	13,100	17,500	22,700	28,500	37,500	43,800	Yes
06170200.03	Willow Creek near Hinsdale, Montana	290	U	RRE wtd	--	--	--	1,610	1,930	3,610	5,200	7,440	9,380	11,700	14,300	18,200	17,400	--
06171000.00	Rock Creek near Hinsdale, Montana	1,300	U	At-site	11	1906-1907, 1912, 1914-1920, 1952	YES	4,320	4,670	6,200	7,440	8,980	10,100	11,200	12,300	13,800	13,800	Yes
06171000.03	Rock Creek near Hinsdale, Montana	1,300	U	RRE wtd	--	--	--	4,140	4,480	5,970	7,230	8,940	10,300	11,600	13,000	14,800	14,100	--
06172200.00	Buggy Creek near Tampico, Montana	124	U	At-site	11	1958-1967, 1972, 1982	YES	614	765	1,700	2,820	4,750	6,600	8,820	11,400	15,600	37,000	--
06172200.03	Buggy Creek near Tampico, Montana	124	U	RRE wtd	--	--	--	464	590	1,390	2,300	3,690	4,910	6,340	8,010	10,500	11,400	Yes
06172300.00	Unger Creek near Vandalia, Montana	10.0	U	At-site	61	1958-2018	--	65	90	280	579	1,220	1,950	2,950	4,270	6,610	5,290	Yes
06172300.03	Unger Creek near Vandalia, Montana	10.0	U	RRE wtd	--	--	--	66	90	273	544	1,080	1,640	2,330	3,180	4,540	3,590	--
06172310.20	Milk River at Tampico, Montana	19,142	Total	At-site	67	1915-1925, 1929-1939, 1952, 1970-1977, 1983-2018	YES	5,720	6,800	12,300	17,600	24,900	30,600	36,400	42,200	50,000	44,200	--
06172310.21	Milk River at Tampico, Montana	19,142	Total	MOVE3	101	1915-1925, 1929-2018	YES	5,760	6,720	11,500	16,000	22,100	27,000	32,000	37,100	44,000	39,100	Yes
06172350.00	Mooney Coulee near Tampico, Montana	13.8	U	At-site	16	1961-1975, 1982	YES	45	59	149	266	481	694	956	1,270	1,770	2,400	--
06172350.03	Mooney Coulee near Tampico, Montana	13.8	U	RRE wtd	--	--	--	53	69	182	351	673	999	1,390	1,850	2,570	2,350	Yes
06173300.00	Willow Creek tributary near Fort Peck, Montana	0.95	U	At-site	19	1972, 1974-1991	YES	63	76	153	241	390	531	698	894	1,210	1,830	--
06173300.03	Willow Creek tributary near Fort Peck, Montana	0.95	U	RRE wtd	--	--	--	58	72	151	247	424	600	813	1,060	1,460	1,400	Yes
06174000.10	Willow Creek near Glasgow, Montana	531	R (MAJ–dam)	At-site	35	1954-1987, 1993	YES	1,760	2,200	4,590	6,900	9,990	12,300	14,500	16,600	19,100	20,600	Yes
06174300.00	Milk River tributary no 3 near Glasgow, Montana	1.55	U	At-site	45	1974-2018	--	27	34	81	139	243	345	469	617	856	886	--
06174300.03	Milk River tributary no 3 near Glasgow, Montana	1.55	U	RRE wtd	--	--	--	27	34	81	142	258	376	520	695	973	817	Yes
06174500.10	Milk River at Nashua, Montana	20,254	R (MAJ–dam)	At-site	79	1940-2018	YES	6,020	6,890	11,200	15,200	20,700	25,200	29,800	34,700	41,500	35,900	--
06174500.11	Milk River at Nashua, Montana	20,254	R (MAJ–dam)	MOVE3	101	1915-1925, 1929-2018	YES	6,870	7,940	13,300	18,300	25,200	30,700	36,500	42,500	50,700	44,200	Yes
06175000.00	Porcupine Creek at Nashua, Montana	724	U	At-site	22	1909-1917, 1954, 1982-1993	YES	633	797	1,880	3,340	6,200	9,250	13,300	18,500	27,700	22,600	--
06175000.03	Porcupine Creek at Nashua, Montana	724	U	RRE wtd	--	--	--	618	777	1,810	3,160	5,650	8,140	11,200	15,000	21,100	17,000	Yes
06177000.10	Missouri River near Wolf Point, Montana	80,650	R (MAJ–dam)	At-site	82	1937-2018	--	17,700	19,100	26,400	33,800	45,600	56,300	68,900	83,800	108,000	92,100	Yes

[1]The streamgage identification number and analysis designation is defined by XXXXXXXX.AB,
where,
XXXXXXXX is the streamgage identification number;
A is the regulation status for the analysis period; and
B is the type of peak-flow frequency analysis.

Values of A (regulation status) are defined as:
A = 0, unregulated;
A = 1, regulated by major regulation; and
A = 2, total; that is, the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation (see footnote 2).

Values of B (type of peak-flow frequency analysis) are defined as:
B = 0, at-site peak-flow frequency analysis conducted on recorded data;
B = 1, peak-flow frequency analysis conducted on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
B = 2, peak-flow frequency analysis determined from regional regression equations (RREs); RRE frequency results not presented in this report; and
B = 3, at-site peak-flow frequency analysis weighted with results from RREs; distributional parameters not available for RRE weighted frequency analyses.

[2]Abbreviations for regulation status are defined as follows:
U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.
R (MAJ–dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
R (MAJ–canal): major diversion canal regulation, where a large diversion canal is known to be located on the channel upstream from the streamgage.
R (MIN–dams): minor dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage, but no single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
Total: the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation, . The "Total" peak-flow frequency analysis is provided in cases where major regulation affects less than 50 percent of the drainage area of the streamgage and there is uncertainty in the effects of regulation on specific peak-flow characteristics. Also, the "Total" peak-flow frequency analysis is the only peak-flow frequency analysis provided in cases of minor dam regulation.

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)	Annual peak flow, in cubic feet per second, for indicated annual exceedance probability, in percent									84 percent confidence level for the 1 percent annual exceedance probability peak flow	Analyses considered by U.S. Geological Survey to be most appropriate for flood-plain mapping purposes[4]
								50	42.9	20	10	4	2	1	0.5	0.2		

[3] Abbreviations for type of frequency analysis are defined as follows:

At-site: peak-flow frequency analysis on recorded data.

RRE wtd: the at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs).

MOVE.3: peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure.

[4] For a given streamgage, the "most appropriate analysis" was selected based on the professional judgements of two or more U. S. Geological Survey analysts. Efforts were made to maintain consistency in the selection process among different streamgages. Major factors considered in the selection process include: (1) the characteristics of the streamgage peak-flow dataset and hydroclimatic regime; and (2) the adequacy of representation of the streamgage peak-flow characteristics and hydroclimatic regime in the development of the regional regression equations (RREs). If a streamgage is affected by major dam regulation and the streamgage peak-flow dataset includes pre- and post-regulation data, the confidence in the determination of regulation effects on the peak flows also was considered in the selection process. If a Maintenance of Variance Extension Type III (MOVE.3) record extension analysis is presented for a streamgage, that analysis is considered "most appropriate." If only one analysis is presented for a streamgage, that analysis is considered "most appropriate."

[4] No analysis for 06143000 is recommended for floodplain mapping as it has a short period of record containing no large flood events which is unlikely to be representative of hydrology at the site. Additionally, results do not nest well with upstream and downstream sites, record extension is not possible due to insufficient overlap with other gages and effects of upstream diversion, and regulation status at the site precludes weighting with regional regression equations.

Table 1–8. Variance of peak-flow frequency estimates.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. U, unregulated; R, regulated; --, not applicable; BP, base period used in the Maintenance of Variance Type III record extension]

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)	Variance, in base 10 logarithm, for indicated annual exceedance probability, in percent								
								50	42.9	20	10	4	2	1	0.5	0.2
06132000.10	Missouri River below Fort Peck Dam, Montana	56,490	R (MAJ–dam)	At-site	82	1937-2018	--	0.0006	0.0006	0.0009	0.0014	0.0027	0.0043	0.0064	0.0091	0.0135
06135000.20	Milk River at Eastern Crossing of International Boundary	2,452	Total	At-site	106	1910-1911, 1913-1915, 1917, 1919-2018	--	0.0012	0.0012	0.0014	0.0020	0.0034	0.0050	0.0071	0.0096	0.0138
06136400.00	Spring Coulee tributary near Simpson, Montana	2.76	U	At-site	30	1972, 1974-2002	YES	0.0395	0.0319	0.0249	0.0354	0.0592	0.0819	0.1079	0.1368	0.1795
06136400.03	Spring Coulee tributary near Simpson, Montana	2.76	U	RRE wtd	--	--	--	0.0297	0.0245	0.0177	0.0201	0.0241	0.0279	0.0332	0.0396	0.0498
06137600.00	Sage Creek tributary no 2 near Joplin, Montana	2.71	U	At-site	45	1974-2018	--	0.0267	0.0223	0.0213	0.0307	0.0490	0.0664	0.0866	0.1100	0.1458
06137600.03	Sage Creek tributary no 2 near Joplin, Montana	2.71	U	RRE wtd	--	--	--	0.0219	0.0184	0.0158	0.0185	0.0222	0.0258	0.0309	0.0370	0.0468
06137900.00	England Coulee at Hingham, Montana	1.61	U	At-site	15	1960-1974	--	0.0259	0.0217	0.0186	0.0284	0.0513	0.0740	0.1007	0.1311	0.1766
06137900.03	England Coulee at Hingham, Montana	1.61	U	RRE wtd	--	--	--	0.0214	0.0180	0.0143	0.0177	0.0229	0.0272	0.0329	0.0396	0.0502
06138700.00	South Fork Spring Coulee near Havre, Montana	6.59	U	At-site	53	1960-2012	--	0.0156	0.0123	0.0097	0.0141	0.0234	0.0320	0.0417	0.0527	0.0689
06138700.03	South Fork Spring Coulee near Havre, Montana	6.59	U	RRE wtd	--	--	--	0.0138	0.0110	0.0084	0.0108	0.0148	0.0180	0.0221	0.0268	0.0341
06138800.00	Spring Coulee near Havre, Montana	18.0	U	At-site	15	1959-1973	--	0.0964	0.0892	0.0927	0.1204	0.1776	0.2340	0.3011	0.3786	0.4962
06138800.03	Spring Coulee near Havre, Montana	18.0	U	RRE wtd	--	--	--	0.0532	0.0478	0.0365	0.0329	0.0323	0.0348	0.0401	0.0471	0.0587
06139500.10	Big Sandy Creek near Havre, Montana	1,787	R (MAJ–dam)	At-site	58	1946-1953, 1955-1967, 1969, 1978, 1984-2018	YES	0.0085	0.0086	0.0103	0.0133	0.0207	0.0297	0.0420	0.0578	0.0845
06140400.00	Bullhook Creek near Havre, Montana	39.1	U	At-site	16	1960-1975, 1986	--	0.0192	0.0180	0.0217	0.0317	0.0503	0.0681	0.0889	0.1127	0.1491
06140400.03	Bullhook Creek near Havre, Montana	39.1	U	RRE wtd	--	--	--	0.0165	0.0153	0.0160	0.0186	0.0221	0.0255	0.0304	0.0364	0.0460
06140500.00	Milk River at Havre, Montana	5,027	U	At-site	24	1899-1922	--	0.0072	0.0070	0.0070	0.0085	0.0126	0.0172	0.0232	0.0305	0.0420
06140500.10	Milk River at Havre, Montana	5,027	R (MAJ–dam)	At-site	66	1952-1953, 1955-2018	YES	0.0037	0.0027	0.0021	0.0037	0.0070	0.0100	0.0135	0.0176	0.0240
06141600.00	Little Box Elder Creek at Mouth near Havre, Montana	95.9	U	At-site	10	1986-1992, 1994-1996	--	0.0322	0.0327	0.0412	0.0545	0.0798	0.1047	0.1349	0.1703	0.2254
06141600.03	Little Box Elder Creek at Mouth near Havre, Montana	95.9	U	RRE wtd	--	--	--	0.0256	0.0251	0.0250	0.0255	0.0276	0.0310	0.0365	0.0434	0.0547
06141900.00	Milk River Tributary near Lohman, Montana	0.18	U	At-site	15	1960-1974	--	0.1666	0.1372	0.1014	0.1426	0.2492	0.3566	0.4824	0.6243	0.8342
06141900.03	Milk River Tributary near Lohman, Montana	0.18	U	RRE wtd	--	--	--	0.0725	0.0617	0.0402	0.0375	0.0384	0.0419	0.0485	0.0569	0.0707
06142400.00	Clear Creek near Chinook, Montana	135	U	At-site	35	1984-2018	--	0.0064	0.0066	0.0091	0.0130	0.0214	0.0308	0.0431	0.0585	0.0840
06142400.03	Clear Creek near Chinook, Montana	135	U	RRE wtd	--	--	--	0.0061	0.0062	0.0080	0.0102	0.0142	0.0180	0.0230	0.0290	0.0386
06143000.10	Milk River at Lohman, Montana	5,340	R (MAJ–dam)	At-site	13	1939-1948, 1950-1952	YES	0.0089	0.0098	0.0114	0.0116	0.0132	0.0168	0.0234	0.0334	0.0525
06144500.10	Lodge Creek below McRae Creek, at International boundary	801	R (MAJ–dam)	At-site	67	1952-2018	YES	0.0151	0.0124	0.0091	0.0091	0.0116	0.0136	0.0160	0.0199
06149500.20	Battle Creek at international boundary	839	Total	At-site	102	1917-2018	--	0.0037	0.0035	0.0036	0.0041	0.0057	0.0077	0.0105	0.0143	0.0206
06151500.00	Battle Creek near Chinook, Montana	1,468	U	At-site	16	1905-1914, 1916-1921	YES	0.0189	0.0181	0.0181	0.0217	0.0311	0.0415	0.0547	0.0707	0.0959
06151500.10	Battle Creek near Chinook, Montana	1,468	R (MIN–dams)	At-site	36	1952, 1984-2018	YES	0.0171	0.0173	0.0189	0.0215	0.0284	0.0370	0.0491	0.0650	0.0923
06153400.10	Fifteenmile Creek tributary near Zurich, Montana	1.70	R (MAJ–dam)	At-site	45	1974-2018	--	0.0147	0.0140	0.0161	0.0212	0.0318	0.0431	0.0577	0.0758	0.1052
06154100.10	Milk River near Harlem, Montana	8,961	R (MAJ–dam)	At-site	48	1952, 1960-1969, 1978, 1983-2018	YES	0.0036	0.0037	0.0043	0.0057	0.0089	0.0128	0.0178	0.0242	0.0347
06154400.00	Peoples Creek near Hays, Montana	227	U	At-site	52	1967-2018	--	0.0106	0.0105	0.0114	0.0140	0.0207	0.0285	0.0389	0.0518	0.0731
06154400.03	Peoples Creek near Hays, Montana	227	U	RRE wtd	--	--	--	0.0097	0.0095	0.0096	0.0107	0.0136	0.0169	0.0212	0.0266	0.0351
06154410.00	Little Peoples Creek near Hays, Montana	12.9	U	At-site	37	1973-2009	--	0.0085	0.0083	0.0090	0.0114	0.0174	0.0243	0.0331	0.0440	0.0616
06154410.03	Little Peoples Creek near Hays, Montana	12.9	U	RRE wtd	--	--	--	0.0080	0.0077	0.0079	0.0092	0.0124	0.0158	0.0201	0.0253	0.0336
06154430.00	Lodge Pole Creek at Lodge Pole, Montana	19.5	U	At-site	14	1987-2000	--	0.0171	0.0165	0.0181	0.0229	0.0433	0.0329	0.0560	0.0710	0.0944
06154430.03	Lodge Pole Creek at Lodge Pole, Montana	19.5	U	RRE wtd	--	--	--	0.0150	0.0143	0.0141	0.0155	0.0186	0.0219	0.0266	0.0322	0.0411
06154490.00	Willow Coulee near Dodson, Montana	5.53	U	At-site	10	1983-1992	YES	0.1200	0.1115	0.0930	0.0949	0.1180	0.1499	0.1938	0.2494	0.3399
06154490.03	Willow Coulee near Dodson, Montana	5.53	U	RRE wtd	--	--	--	0.0598	0.0538	0.0368	0.0309	0.0299	0.0325	0.0379	0.0449	0.0565
06154510.20	Kuhr Coulee Tributary near Dodson, Montana	1.34	Total	At-site	32	1983-2018	--	0.0163	0.0155	0.0180	0.0240	0.0361	0.0487	0.0645	0.0836	0.1142
06154510.23	Kuhr Coulee Tributary near Dodson, Montana	1.34	Total	RRE wtd	--	--	--	0.0144	0.0135	0.0140	0.0159	0.0193	0.0229	0.0279	0.0339	0.0436
06154550.00	Peoples Creek below Kuhr Coulee near Dodson, Montana	688	U	At-site	50	1906, 1952-1966, 1968-1973, 1982-2009	YES	0.0065	0.0063	0.0059	0.0063	0.0084	0.0114	0.0156	0.0211	0.0303
06154550.03	Peoples Creek below Kuhr Coulee near Dodson, Montana	688	U	RRE wtd	--	--	--	0.0062	0.0059	0.0054	0.0056	0.0070	0.0090	0.0118	0.0153	0.0211
06155030.10	Milk River near Dodson, Montana	10,442	R (MAJ–dam)	At-site	36	1983-2018	YES	0.0088	0.0084	0.0074	0.0078	0.0101	0.0135	0.0184	0.0247	0.0352
06155030.11	Milk River near Dodson, Montana	10,442	R (MAJ–dam)	MOVE3	41	1978-2018	YES	0.0101	0.0092	0.0076	0.0073	0.0081	0.0099	0.0126	0.0162	0.0224
06155100.00	Black Coulee near Malta, Montana	11.7	U	At-site	13	1956-1967, 1986	YES	0.0240	0.0241	0.0271	0.0329	0.0448	0.0574	0.0733	0.0924	0.1230
06155100.03	Black Coulee near Malta, Montana	11.7	U	RRE wtd	--	--	--	0.0200	0.0195	0.0187	0.0191	0.0210	0.0239	0.0285	0.0341	0.0433
06155200.20	Alkali Creek near Malta, Montana	184	Total	At-site	17	1906, 1956-1959, 1961-1964, 1966, 1968-1973, 1986	YES	0.1014	0.0818	0.0313	0.0229	0.0430	0.0757	0.1204	0.1758	0.2636
06155300.00	Disjardin Coulee near Malta, Montana	3.77	U	At-site	47	1956-2002	--	0.0075	0.0080	0.0116	0.0173	0.0307	0.0463	0.0672	0.0939	0.1387
06155300.03	Disjardin Coulee near Malta, Montana	3.77	U	RRE wtd	--	--	--	0.0071	0.0074	0.0098	0.0126	0.0174	0.0220	0.0278	0.0348	0.0458

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)	Variance, in base 10 logarithm, for indicated annual exceedance probability, in percent								
								50	42.9	20	10	4	2	1	0.5	0.2
06155400.00	Taylor Coulee near Malta, Montana	4.93	U	At-site	18	1956-1973	--	0.0880	0.0694	0.0386	0.0510	0.0941	0.1397	0.1935	0.2541	0.3431
06155400.03	Taylor Coulee near Malta, Montana	4.93	U	RRE wtd	--	--	--	0.0507	0.0416	0.0236	0.0242	0.0282	0.0321	0.0380	0.0452	0.0567
06155500.20	Milk River at Malta, Montana	11,186	Total	At-site	26	1903-1909, 1911-1913, 1915-1922, 1952, 1986, 2013-2018	YES	0.0016	0.0015	0.0015	0.0017	0.0023	0.0029	0.0036	0.0045	0.0061
06155900.10	Milk River at Cree Crossing near Saco, Montana	12,337	R (MAJ–dam)	At-site	11	2000-2009, 2011	YES	0.0177	0.0167	0.0176	0.0223	0.0318	0.0412	0.0524	0.0654	0.0854
06155900.11	Milk River at Cree Crossing near Saco, Montana	12,337	R (MAJ–dam)	MOVE3	41	1978-2018	YES	0.0063	0.0062	0.0062	0.0072	0.0101	0.0136	0.0184	0.0245	0.0345
06156000.00	Whitewater Creek near international boundary	420	U	At-site	52	1927-1933, 1935-1979	YES	0.0161	0.0133	0.0117	0.0155	0.0228	0.0298	0.0378	0.0471	0.0612
06156000.03	Whitewater Creek near international boundary	420	U	RRE wtd	--	--	--	0.0142	0.0118	0.0098	0.0116	0.0146	0.0175	0.0212	0.0256	0.0325
06156100.00	Lush Coulee near Whitewater, Montana	8.90	U	At-site	46	1972, 1974-2018	YES	0.0243	0.0223	0.0224	0.0277	0.0401	0.0539	0.0717	0.0936	0.1288
06156100.03	Lush Coulee near Whitewater, Montana	8.90	U	RRE wtd	--	--	--	0.0202	0.0183	0.0164	0.0172	0.0200	0.0233	0.0283	0.0344	0.0441
06164000.20	Frenchman River at international boundary	1,960	Total	At-site	102	1917-2018	YES	0.0016	0.0017	0.0021	0.0030	0.0055	0.0087	0.0131	0.0188	0.0287
06164510.10	Milk River at Juneberg Bridge near Saco, Montana	15,713	R (MAJ–dam)	At-site	41	1978-2018	YES	0.0058	0.0056	0.0052	0.0058	0.0082	0.0113	0.0157	0.0213	0.0306
06164510.11	Milk River at Juneberg Bridge near Saco, Montana	15,713	R (MAJ–dam)	MOVE3	101	1915-1925, 1929-2018	YES	0.0029	0.0025	0.0022	0.0023	0.0028	0.0036	0.0048	0.0063	0.0089
06164590.00	Beaver Creek near Zortman, Montana	10.4	U	At-site	9	1984-1992	--	0.0382	0.0403	0.0564	0.0778	0.1167	0.1547	0.2005	0.2545	0.3386
06164590.03	Beaver Creek near Zortman, Montana	10.4	U	RRE wtd	--	--	--	0.0292	0.0293	0.0298	0.0296	0.0309	0.0341	0.0398	0.0471	0.0591
06164600.00	Beaver Creek tributary near Zortman, Montana	3.76	U	At-site	45	1974-2018	--	0.0100	0.0103	0.0132	0.0184	0.0302	0.0436	0.0614	0.0837	0.1205
06164600.03	Beaver Creek tributary near Zortman, Montana	3.76	U	RRE wtd	--	--	--	0.0092	0.0094	0.0109	0.0132	0.0173	0.0214	0.0268	0.0333	0.0436
06164615.00	Little Warm Creek at Reservation Boundary near Zortman, Montana	5.75	U	At-site	10	1983-1992	--	0.0519	0.0546	0.0756	0.1044	0.1574	0.2098	0.2731	0.3480	0.4650
06164615.03	Little Warm Creek at Reservation Boundary near Zortman, Montana	5.75	U	RRE wtd	--	--	--	0.0362	0.0358	0.0337	0.0318	0.0319	0.0346	0.0402	0.0473	0.0591
06164623.00	Little Warm Creek Tributary near Lodge Pole, Montana	2.39	U	At-site	36	1983-2018	--	0.0130	0.0126	0.0131	0.0161	0.0244	0.0340	0.0465	0.0620	0.0869
06164623.03	Little Warm Creek Tributary near Lodge Pole, Montana	2.39	U	RRE wtd	--	--	--	0.0117	0.0113	0.0108	0.0120	0.0153	0.0189	0.0237	0.0294	0.0385
06164800.00	Beaver Creek above Dix Creek near Malta, Montana	914	U	At-site	17	1917-1921, 1967-1969, 1974, 1976-1982, 1986	YES	0.0377	0.0321	0.0228	0.0244	0.0315	0.0391	0.0481	0.0582	0.0731
06164800.03	Beaver Creek above Dix Creek near Malta, Montana	914	U	RRE wtd	--	--	--	0.0289	0.0247	0.0167	0.0161	0.0180	0.0206	0.0243	0.0289	0.0360
06165200.10	Guston Coulee near Malta, Montana	2.40	R (MAJ–dam)	At-site	45	1974-2018	--	0.0315	0.0242	0.0162	0.0235	0.0405	0.0563	0.0740	0.0933	0.1211
06165200.13	Guston Coulee near Malta, Montana	2.40	R (MAJ–dam)	RRE wtd	--	--	--	0.0250	0.0197	0.0128	0.0156	0.0203	0.0242	0.0292	0.0350	0.0440
06166000.20	Beaver Creek below Guston Coulee near Saco, Montana	1,199	Total	At-site	42	1904-1906, 1911-1912, 1920-1921, 1982-1993, 1995-2018	YES	0.0095	0.0093	0.0092	0.0099	0.0128	0.0169	0.0230	0.0310	0.0450
06167500.20	Beaver Creek near Hinsdale, Montana	1,678	Total	At-site	18	1912, 1919-1921, 2005-2018	YES	0.0101	0.0094	0.0078	0.0080	0.0103	0.0136	0.0181	0.0239	0.0334
06167500.21	Beaver Creek near Hinsdale, Montana	1,678	Total	MOVE3	43	1905-1906, 1911-1912, 1919-1921, 1982-1993, 1995-2018	YES	0.0045	0.0044	0.0042	0.0044	0.0057	0.0076	0.0103	0.0138	0.0200
06168500.00	Rock Creek at international boundary	239	U	At-site	35	1927-1961	--	0.0069	0.0066	0.0065	0.0078	0.0117	0.0163	0.0225	0.0301	0.0422
06168500.01	Rock Creek at international boundary	239	U	MOVE3	47	1915-1961	--	0.0046	0.0043	0.0040	0.0046	0.0071	0.0103	0.0145	0.0197	0.0280
06169000.00	Horse Creek at international boundary	74.9	U	At-site	46	1915-1933, 1935-1961	YES	0.0064	0.0060	0.0055	0.0062	0.0089	0.0124	0.0171	0.0229	0.0323
06169000.01	Horse Creek at international boundary	74.9	U	MOVE3	103	1915-1933, 1935-2018	YES	0.0027	0.0025	0.0024	0.0028	0.0038	0.0052	0.0071	0.0095	0.0136
06169500.00	Rock Creek below Horse Creek near International boundary	322	U	At-site	72	1917, 1919-1926, 1952, 1957-2018	YES	0.0033	0.0030	0.0029	0.0032	0.0040	0.0050	0.0064	0.0083	0.0114
06169500.01	Rock Creek below Horse Creek near International boundary	322	U	MOVE3	103	1915-1933, 1935-2018	YES	0.0020	0.0019	0.0019	0.0022	0.0031	0.0042	0.0058	0.0079	0.0114
06170000.00	McEachern Creek at international boundary	171	U	At-site	53	1924-1976	YES	0.0065	0.0062	0.0060	0.0063	0.0077	0.0098	0.0128	0.0168	0.0235
06170000.03	McEachern Creek at international boundary	171	U	RRE wtd	--	--	--	0.0062	0.0059	0.0055	0.0055	0.0065	0.0079	0.0101	0.0128	0.0174
06170200.00	Willow Creek near Hinsdale, Montana	290	U	At-site	10	1965-1973, 1979	YES	0.0245	0.0231	0.0209	0.0229	0.0304	0.0394	0.0513	0.0661	0.0900
06170200.03	Willow Creek near Hinsdale, Montana	290	U	RRE wtd	--	--	--	0.0204	0.0189	0.0156	0.0153	0.0174	0.0203	0.0247	0.0301	0.0389
06171000.00	Rock Creek near Hinsdale, Montana	1,300	U	At-site	11	1906-1907, 1912, 1914-1920, 1952	YES	0.0040	0.0039	0.0039	0.0043	0.0052	0.0062	0.0074	0.0090	0.0115
06171000.03	Rock Creek near Hinsdale, Montana	1,300	U	RRE wtd	--	--	--	0.0039	0.0038	0.0037	0.0039	0.0046	0.0054	0.0064	0.0078	0.0099
06172200.00	Buggy Creek near Tampico, Montana	124	U	At-site	11	1958-1967, 1972, 1982	YES	0.0536	0.0444	0.0240	0.0244	0.0399	0.0596	0.0849	0.1150	0.1615
06172200.03	Buggy Creek near Tampico, Montana	124	U	RRE wtd	--	--	--	0.0367	0.0310	0.0177	0.0171	0.0241	0.0316	0.0407	0.0511	0.0666
06172300.00	Unger Creek near Vandalia, Montana	10.0	U	At-site	61	1958-2018	--	0.0110	0.0109	0.0123	0.0156	0.0235	0.0329	0.0455	0.0616	0.0884
06172300.03	Unger Creek near Vandalia, Montana	10.0	U	RRE wtd	--	--	--	0.0100	0.0098	0.0104	0.0122	0.0169	0.0220	0.0286	0.0366	0.0493
06172310.20	Milk River at Tampico, Montana	19,142	Total	At-site	67	1915-1925, 1929-1939, 1952, 1970-1977, 1983-2018	YES	0.0032	0.0031	0.0029	0.0031	0.0038	0.0049	0.0065	0.0087	0.0123
06172310.21	Milk River at Tampico, Montana	19,142	Total	MOVE3	101	1915-1925, 1929-2018	YES	0.0018	0.0016	0.0017	0.0020	0.0028	0.0037	0.0049	0.0064	0.0090
06172350.00	Mooney Coulee near Tampico, Montana	13.8	U	At-site	16	1961-1975, 1982	YES	0.0325	0.0288	0.0263	0.0337	0.0501	0.0663	0.0855	0.1075	0.1406
06172350.03	Mooney Coulee near Tampico, Montana	13.8	U	RRE wtd	--	--	--	0.0254	0.0224	0.0188	0.0211	0.0273	0.0331	0.0405	0.0492	0.0622
06173300.00	Willow Creek tributary near Fort Peck, Montana	0.95	U	At-site	19	1972, 1974-1991	YES	0.0233	0.0188	0.0135	0.0197	0.0354	0.0512	0.0696	0.0902	0.1205
06173300.03	Willow Creek tributary near Fort Peck, Montana	0.95	U	RRE wtd	--	--	--	0.0195	0.0159	0.0113	0.0148	0.0227	0.0297	0.0376	0.0466	0.0598
06174000.10	Willow Creek near Glasgow, Montana	531	R (MAJ–dam)	At-site	35	1954-1987, 1993	YES	0.0107	0.0094	0.0072	0.0072	0.0090	0.0118	0.0157	0.0205	0.0281
06174300.00	Milk River tributary no 3 near Glasgow, Montana	1.55	U	At-site	45	1974-2018	--	0.0146	0.0114	0.0085	0.0128	0.0222	0.0310	0.0409	0.0520	0.0683

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)	Variance, in base 10 logarithm, for indicated annual exceedance probability, in percent								
								50	42.9	20	10	4	2	1	0.5	0.2
06174300.03	Milk River tributary no 3 near Glasgow, Montana	1.55	U	RRE wtd	--	--	--	0.0130	0.0103	0.0075	0.0105	0.0163	0.0212	0.0268	0.0332	0.0426
06174500.10	Milk River at Nashua, Montana	20,254	R (MAJ–dam)	At-site	79	1940-2018	YES	0.0017	0.0016	0.0017	0.0022	0.0031	0.0041	0.0054	0.0070	0.0098
06174500.11	Milk River at Nashua, Montana	20,254	R (MAJ–dam)	MOVE3	101	1915-1925, 1929-2018	YES	0.0015	0.0014	0.0015	0.0018	0.0026	0.0035	0.0047	0.0064	0.0091
06175000.00	Porcupine Creek at Nashua, Montana	724	U	At-site	22	1909-1917, 1954, 1982-1993	YES	0.0162	0.0162	0.0186	0.0221	0.0287	0.0359	0.0453	0.0572	0.0774
06175000.03	Porcupine Creek at Nashua, Montana	724	U	RRE wtd	--	--	--	0.0143	0.0140	0.0147	0.0161	0.0198	0.0238	0.0291	0.0359	0.0468
06177000.10	Missouri River near Wolf Point, Montana	80,650	R (MAJ–dam)	At-site	82	1937-2018	--	0.0006	0.0006	0.0009	0.0016	0.0035	0.0059	0.0092	0.0135	0.0208

[1]The streamgage identification number and analysis designation is defined by XXXXXXXX.AB,
where,
XXXXXXXX is the streamgage identification number;
A is the regulation status for the analysis period; and
B is the type of peak-flow frequency analysis.

Values of A (regulation status) are defined as:
A = 0, unregulated;
A = 1, regulated by major regulation; and
A = 2, total; that is, the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation (see footnote 2).

Values of B (type of peak-flow frequency analysis) are defined as:
B = 0, at-site peak-flow frequency analysis conducted on recorded data;
B = 1, peak-flow frequency analysis conducted on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
B = 2, peak-flow frequency analysis determined from regional regression equations (RREs); RRE frequency results not presented in this report; and
B = 3, at-site peak-flow frequency analysis weighted with results from RREs; distributional parameters not available for RRE weighted frequency analyses.

[2]Abbreviations for regulation status are defined as follows:
U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.
R (MAJ–dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
R (MAJ–canal): major diversion canal regulation, where a large diversion canal is known to be located on the channel upstream from the streamgage.
R (MIN–dams): minor dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage, but no single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
Total: the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation, . The "Total" peak-flow frequency analysis is provided in cases where major regulation affects less than 50 percent of the drainage area of the streamgage and there is uncertainty in the effects of regulation on specific peak-flow characteristics. Also, the "Total" peak-flow frequency analysis is the only peak-flow frequency analysis provided in cases of minor dam regulation.

[3]Abbreviations for type of frequency analysis are defined as follows:
At-site: peak-flow frequency analysis on recorded data.
RRE wtd: the at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs).
MOVE.3: peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure.